United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Michigan Department of
Agriculture, Michigan
Agriculture Experiment
Station, Michigan State
University Extension, and
Michigan Technological
University

Soil Survey of Kalkaska County, Michigan

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

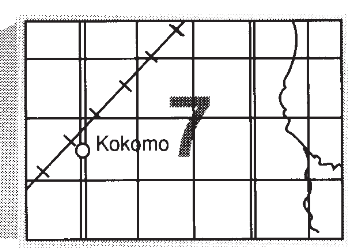
Detailed Soil Maps

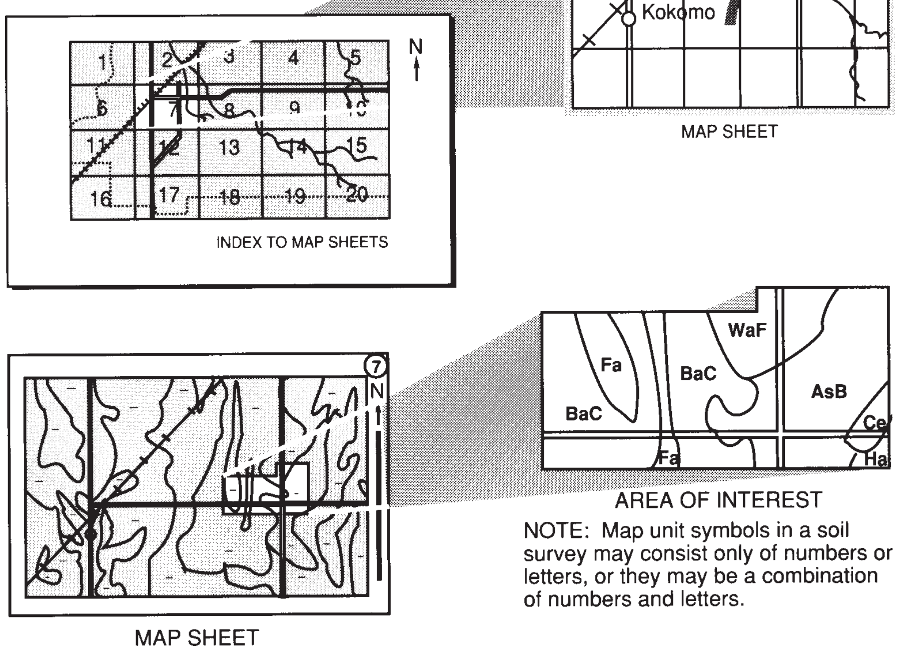
The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.





NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1997. Soil names and descriptions were approved in 1998. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1997. This survey was made cooperatively by the Natural Resources Conservation Service, the Michigan Department of Agriculture, the Michigan Agriculture Experiment Station, the Michigan State University Extension, and the Michigan Technological University. The survey is part of the technical assistance furnished to the Kalkaska Soil Conservation District. The Kalkaska County Board of Commissioners provided financial assistance for the survey.

Cover: Kalkaska County has 86 inland lakes and is 70 percent forested.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov.

Contents

Issued 2005

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

John A. Bricker
State Conservationist
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Soil Survey of
Kalkaska County, Michigan

By Joseph K. Calus, Natural Resources Conservation Service

Fieldwork by Joseph Calus, Brad Snead, and Bruce Knapp, Natural Resources Conservation Service, and Tom Bauer, Michigan Department of Agriculture

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
Michigan Department of Agriculture, Michigan Agriculture Experiment Station, Michigan State University Extension, and Michigan Technological University

Kalkaska County in the northwestern part of the Lower Peninsula of Michigan (fig. 1). It is bordered by Antrim County to the north, Crawford County to the east, Missaukee County to the south, and Grand Traverse County to the west. It has a total area of 365,030 acres, or about 564 square miles. The land area is 360,294 acres. The village of Kalkaska is the county seat and is located in the northwestern part of the county. In 1990, it had a population of more than 2,000.

About 70 percent of the county is forested. Manufactoring, oil and gas exploration, forest products, recreation, and tourism are the main economic enterprises.

This soil survey updates the survey of Kalkaska County published in 1927 *(18)*. It provides additional information and has larger maps, which show the soils in greater detail.

Figure 1.—Location of Kalkaska County in Michigan.

General Nature of the Survey Area

This section gives general information about Kalkaska County. It discusses history and development, industry and transportation, physiography, farming, lakes and rivers, and climate.

History and Development

In 1840, shortly after Michigan became a state, the survey area was part of Wabassee County. In 1853, it became part of Grand Traverse County, and, later, Antrim County. The first settlers arrived in 1855. In 1871, the survey area was finally organized under the name of Kalkaska County *(10)*.

When Native Americans inhabited the survey area, the land was covered with tall white pine trees.

Eventually, lumbermen cleared the land and moved north in search of more forest. The lumbermen left behind small communities that evolved into farming based towns.

In the 1930's when the Great Depression hit the country, much of the privately owned land in the survey area reverted to the State.

Oil and gas were discovered in the county around the late 1950's and early 1960's. Major drilling began in the 1970's, and more than 100 producing wells were established.

Industry and Transportation

The major industries in Kalkaska County are manufacturing and oil and gas exploration. Other industries include construction, tourism, and forest products.

The main U.S. Highway in the county is U.S. Highway 131, which runs northeast and southwest through the western half of the county. The major State Highways are M-72, which runs east and west through the central and northwestern part of the county, and M-66, which runs north and south through the west-central part of the county. Other frequently traveled county roads are County Roads 612, 597, and 571 and Boardman and Fletcher Roads. One railroad frieght line serves the county. The only airport in the county is just west of the village of Kalkaska.

Physiography

Prepared by Tom Bauer, Soil Scientist, Michigan Department of Agriculture.

The physiography of Kalkaska County consists of a thick mantle of variably stratified sandy glacial deposits over sedimentary bedrock. The present-day landforms were created about 11,000 years ago, toward the end of the last Ice Age. The complex movement of the Lake Michigan Lobe of the Wisconsin glacial ice sheet resulted in five dominant landform features: kame moraines, lake plains, outwash plains, remnant moraines, and kames and drainageways (flood plains) (fig. 2). The general soil map can be used to locate landforms within the county as they relate to soil types.

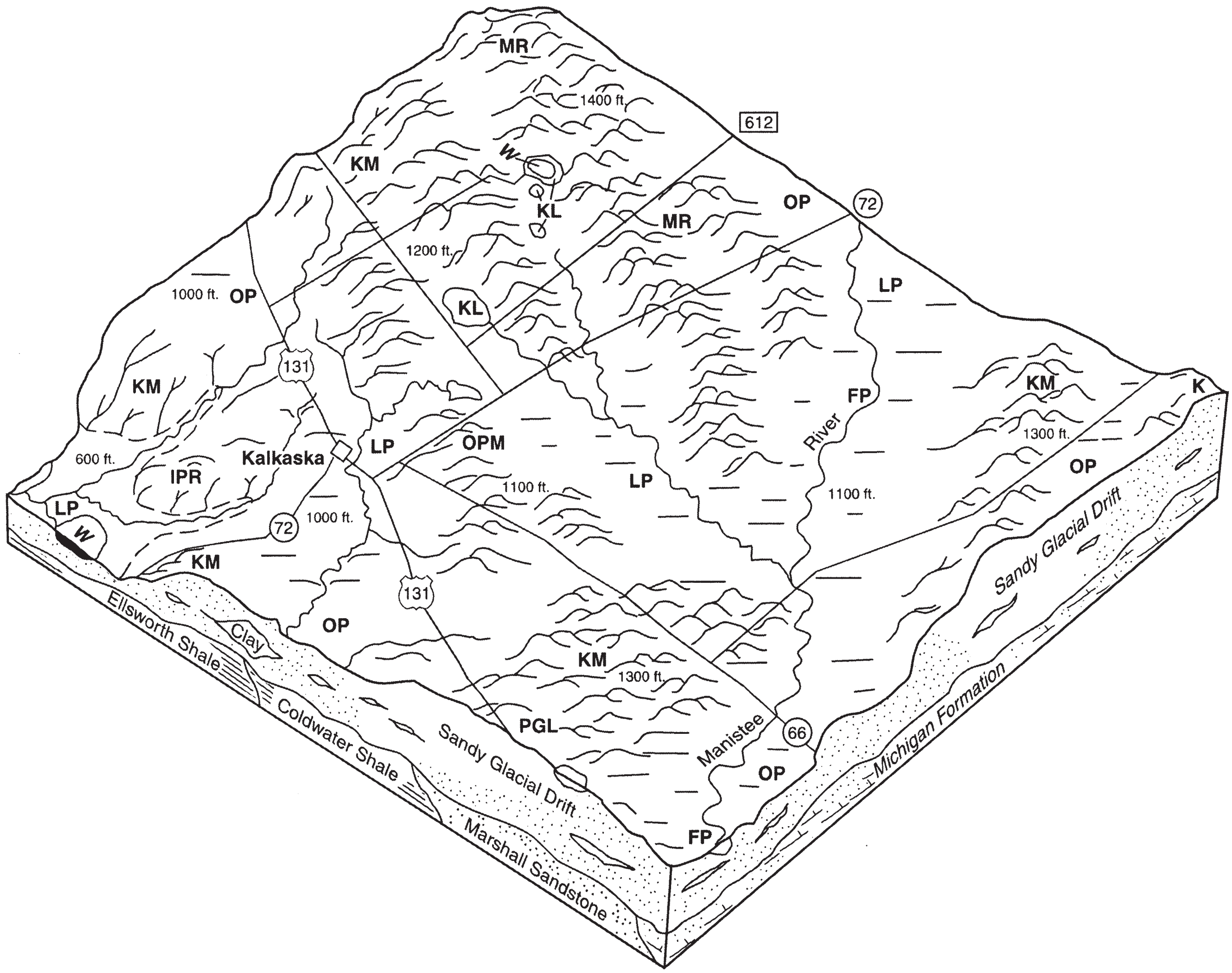
The thickness of glacial drift (unconsolidated sediment) over bedrock ranges from a maximum of about 700 feet to a minimum of 400 feet *(3)*. A major moraine has been recognized in the county *(13)*. The Port Huron moraine is a large morainic system that extends around the state, running roughly parallel to the coast. It marks a major position of the glacial ice sheet. Within the county the moraine has properties of a kame moraine—a moraine formed by outwash deposits *(6)*. The moraine is recognized as two distinct ridges trending northeastward. These ridges have been labeled the Inner and Outer Port Huron Moraines *(3)*. The kame moraine is composed of dominantly sandy materials that were scraped up and transported from areas that the glacier moved over and then deposited at the front of the melting stagnant glacial ice sheet. Small masses of flow till (loamy material) and thin to thick gravelly layers are incorporated into the sandy matrix.

The Inner Port Huron Moraine is in the northwestern part of the county. Its peak elevation of 1,050 feet drops steeply to 600 feet on its northwestern flank, and the moraine contains numerous kettles. The moraine marks the edge of a glacial ice sheet that melted. Southeast of this moraine lies a sandy outwash plain that was a drainage channel fed by the melting glacier. The village of Kalkaska is located on this plain. A clay deposit underlies this outwash plain at a depth of 50 to 150 feet *(3)* .

Located further to the southeast is the Outer Port Huron Moraine, a wide, rolling ridge that rises from 1,000 to 1,300 feet in elevation. A complex progression of small proglacial lakes formed on the lower northwestern flank between the ice front and the Outer Port Huron Moraine. Several kettles, including Manistee Lake, are located on this moraine *(3)*. In the northeastern part of the county, the Outer Port Huron Moraine has been dissected and channelized into a morainic remnant. It has the highest elevations in the county (1,400 feet). A portion of the older Lake Border Morainic System extends through the southeastern corner of the county. It is marked by some high ridges (1,300 feet) and is also mostly sandy material.

There are several areas in the county that were lakes at one time but for various reasons are now land. An area of lake plain in the northwestern corner of the county was part of postglacial Lake Nipissing *(11)*. It formed late in the Ice Age when the land surface was still depressed from the weight of the glacier and Lake Nipissing (glacial Lake Michigan) was at a high level. Two other lake plains are located in the central and eastern parts of the county. These areas may have formed after the Manistee River was dammed by glacial ice and debris. They are generally level areas of poorly drained sandy and organic soils that formed as shallow lakes filled with decomposed vegetation. Some lake bed deposits in the hilly areas on the northwestern flank of the Outer Port Huron Moraine were produced by temporary proglacial lakes.

Drainageways in Kalkaska County follow the course



Key to Landforms

KM - Kame Moraine	K - Kame	FP - Flood plain & Terraces	IRP - Inner Port Huron Moraine
LP - Lake Plain	OP - Outwash Plain		
MR - Morainic Remnant	KL - Kettle Lake	Pgl - Proglacial Lake Deposits	OPM - Outer Port Huron Moraine

Figure 2.—Physiography of Kalkaska County, Michigan. The scale is 1:250,000.

of the many streams and rivers. The Manistee River drains the southern and eastern parts of the county. The Rapid River drains the northwestern area of the county. The Boardman River drains the western and north-central parts of the county.

The bedrock in the survey area is of sedimentary origin. It has been downwarped toward the center of the State and forms the edge of a huge bowl-like structure called the Michigan Basin *(5)*. This bedrock formed during the Mississippian Period of the Paleozoic Era about 330,000 years ago. It consists of four major stratigraphic units: the Ellsworth Shale, the

Coldwater Shale, the Marshall Sandstone, and the Michigan Formation. These strata are responsible for much of the gas and oil development in the region.

The Ellsworth Shale is in the northwestern corner of the county. It is a soft green shale and the oldest of the bedrocks. The Coldwater Shale runs through the north-central part of the county. It is variable in color and contains scattered sand lenses. The Marshall Sandstone subcrops in the south-central part of the county and is light gray to white. The southern part of the county is underlain by the Michigan Formation, which is composed of shale, gypsum, dolomite, limestone, and a small amount of sandstone *(5)*.

Farming

Although farming in Kalkaska County is not the most important industry, it does impact the economy. About 109,509 acres in the county, or nearly 30 percent of the total land area, is active or inactive farmland. In 1992, row crops such as corn, wheat, oats, and potatoes were harvested on approximately 2,570 acres *(14)*.

The rest of the agriculture in the county consists of livestock enterprises and hay crops. The livestock are mainly hogs, beef cattle, and dairy cows. Alfalfa is the primary hay crop.

The production of Christmas trees is also an important enterprise. Christmas tree plantations make up approximately 10,000 acres in Kalkaska County.

Lakes and Rivers

Kalkaska County has about 86 inland lakes and 3 major rivers. The largest lakes are Manistee Lake (860 acres), Bear Lake (316 acres), Crawford Lake (160 acres), Big Twin Lake (215 acres), and Starvation Lake (125 acres). Bodies of water that are more than 40 acres in size make up about 4,735 acres of the survey area.

The major rivers are the Manistee River, the North Branch of the Manistee River, the Rapid River, and the North and South Branches of the Boardman River. The Manistee River and the North Branch of the Manistee River flow southwest through Excelsior, Oliver, Garfield, Springfield, and Bear Lake Townships into Missaukee County. The Rapid River flows northwest through Kalkaska, Rapid River, and Clearwater Townships and empties into Torch Lake. The North and South Branches of the Boardman River flow west, mainly through Kalkaska Township into Grand Traverse County.

Also included in the county's water resources are many streams, creeks, wetlands, and ponds.

Climate

Tables 1A and 1B give data on temperature and precipitation for the survey area as recorded at Grayling and Lake City, Michigan, in the period 1961 to 1990. Tables 2A and 2B show probable dates of the first freeze in fall and the last freeze in spring. Tables 3A and 3B provide data on length of the growing season.

In winter, the average temperature is 18.7 degrees F and the average daily minimum temperature is 9.3 degrees. The lowest temperature on record, which occurred on Febuary 17, 1979, is 42 degrees. In summer, the average temperature is 64.9 degrees and the average daily maximum temperature is 78.4 degrees. The highest recorded temperature, which occurred on July 20, 1977, is 100 degrees.

Growing degree days are shown in tables 1A and 1B. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 or 50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation averages about 31.0 inches. Of this, 10.72 inches, or about 33 percent, usually falls in June through August. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 5.02 inches on August 9, 1965. Thunderstorms occur on about 35 days each year, and most occur in July.

The average seasonal snowfall, as recorded at Kalkaska, Michigan, is about 126 inches. The greatest snow depth at any one time during the period of record was 46 inches. On the average, 115 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 63 percent. Humidity is higher at night, and the average at dawn is about 84 percent. The sun shines 66 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 9.0 miles per hour, in April.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists

observed the steepness, length, and shape of the slopes; the general pattern of drainage; and the kinds of crops and native plants. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Survey Procedures

The general procedures followed in making this survey are described in the “National Soil Survey Handbook” of the Natural Resources Conservation Service.

The soil survey maps that were made for conservation planning prior to the start of the project and the 1927 soil survey of the county were among the references used. Before the actual fieldwork began, preliminary boundaries of slopes and

landforms were plotted stereoscopically on 1:20,000 leaf-off aerial photography. U.S. Geologic Survey topographic maps at a scale of 1:24,000 helped the soil scientists to relate land and image features.

A reconnaissance was made by truck before the soil scientists traversed the surface on foot to examine the soils. In areas where the soil pattern was very complex, traverses and random observations were spaced as close as 200 yards. In areas where the soil pattern was relatively simple, traverses were about 0.25 mile apart.

As the soil scientists traversed the surface, they divided the landscape into segments. For example, a hillside would be separated from a swale or a gently sloping ridgetop would be separated from a very steep side slope.

Observations of such items as landforms, blown-down trees, vegetation, and roadbanks were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined with the aid of a hand auger or a spade to a depth of about 6 feet. The pedons described as typical were observed and studied in pits that were dug with shovels, mattocks, and digging bars.

Notes were taken on the composition of map units during the first year of the project. These notes were supplemented with additional notes as mapping progressed and the composition of individual map units was made.

Samples for chemical and physical analyses were taken from representative sites of some soils in the survey area. The analyses were made by the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan, and the National Soil Survey Laboratory, Lincoln, Nebraska. The results of the studies can be obtained on request from the two laboratories or from the State Office of the Natural Resources Conservation Service in East Lansing.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs. Cultural features were recorded from observations of the maps and the landscape.

General Soil Map Units

The general soil map shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, drainage, and other characteristics that affect management.

1. Lupton-Tawas-Roscommon

Nearly level, very poorly drained, mucky soils on moraines, outwash plains, and lake plains

Setting

Landform: Lake plains, outwash plains, and moraines (fig. 3)
Slope range: 0 to 2 percent

Composition

Extent of map unit in the survey area: 6 percent
Extent of the soils in the map unit:
Lupton soils—33 percent
Tawas soils—33 percent
Roscommon soils—15 percent
Minor soils—19 percent

Soil Properties and Qualities

Lupton

Drainage class: Very poorly drained
Position on landform: Depressions and drainageways
Parent material: Herbaceous material
Surface textural class: Muck
Slope: Nearly level

Tawas

Drainage class: Very poorly drained
Position on landform: Depressions and drainageways
Parent material: Herbaceous material over sandy sediments
Surface textural class: Muck
Slope: Nearly level

Roscommon

Drainage class: Very poorly drained
Position on landform: Depressions and drainageways
Parent material: Sandy sediments
Surface textural class: Mucky sand
Slope: Nearly level

Minor Soils

- Au Gres soils that are somewhat poorly drained, on toeslopes
- Rubicon soils that are excessively drained, on knolls

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
- Because of the wetness, access roads should be utilized only when frozen and harvesting methods should leave trees widely spaced.
- Trees should not be planted due to the wetness.

2. Algonquin-Allendale-Negwegon

Nearly level to moderately sloping, somewhat poorly drained and moderately well drained, sandy and loamy soils on lake plains

Setting

Landform: Lake plains (fig. 4)
Slope range: 0 to 12 percent

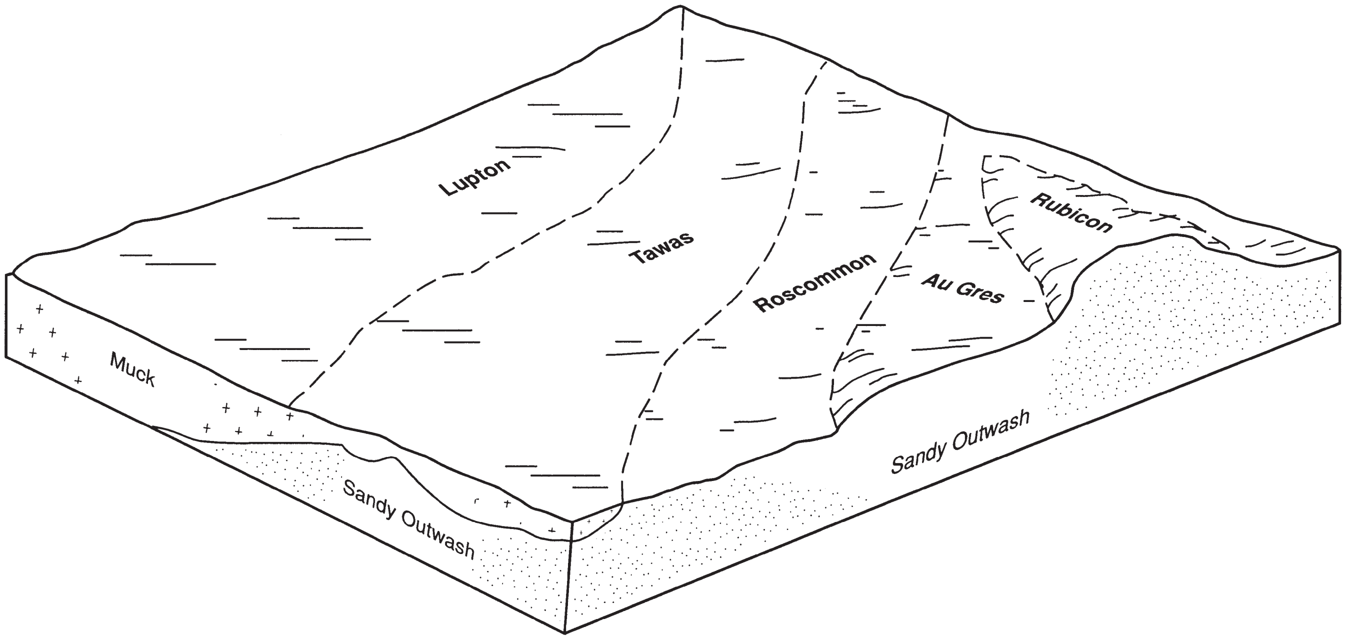


Figure 3.—Typical pattern of soils and parent material in the Lupton-Tawas-Roscommon general soil map unit.

Composition

Extent of map unit in the survey area: 1 percent
Extent of the soils in the map unit:
Algonquin soils—35 percent
Allendale soils—30 percent
Negwegon soils—20 percent
Minor soils—15 percent

Soil Properties and Qualities

Algonquin

Drainage class: Somewhat poorly drained
Position on landform: Flats and toeslopes
Parent material: Clayey sediments
Surface textural class: Silt loam
Slope: Nearly level to undulating

Allendale

Drainage class: Somewhat poorly drained
Position on landform: Flats and toeslopes
Parent material: Sandy over clayey sediments
Surface textural class: Loamy sand
Slope: Nearly level to undulating

Negwegon

Drainage class: Moderately well drained
Position on landform: Knolls
Parent material: Clayey sediments
Surface textural class: Silt loam
Slope: Nearly level to moderately sloping

Minor Soils

- Springport soils that are poorly drained, in drainageways
- Wakeley soils that are very poorly drained, in depressions

Use and Management

Major uses: Cropland
Management concerns: Seasonal wetness, water erosion, and soil blowing
Management measures and considerations:
- Surface and subsurface drains can help to minimize wetness.
- Leaving crop residue on the surface and planting close-growing crops help to minimize water erosion.
- Windbreaks help to control soil blowing.

3. Rubicon-Grayling-Croswell

Nearly level to strongly sloping, excessively drained and moderately well drained, sandy soils on outwash plains

Setting

Landform: Outwash plains
Slope range: 0 to 18 percent

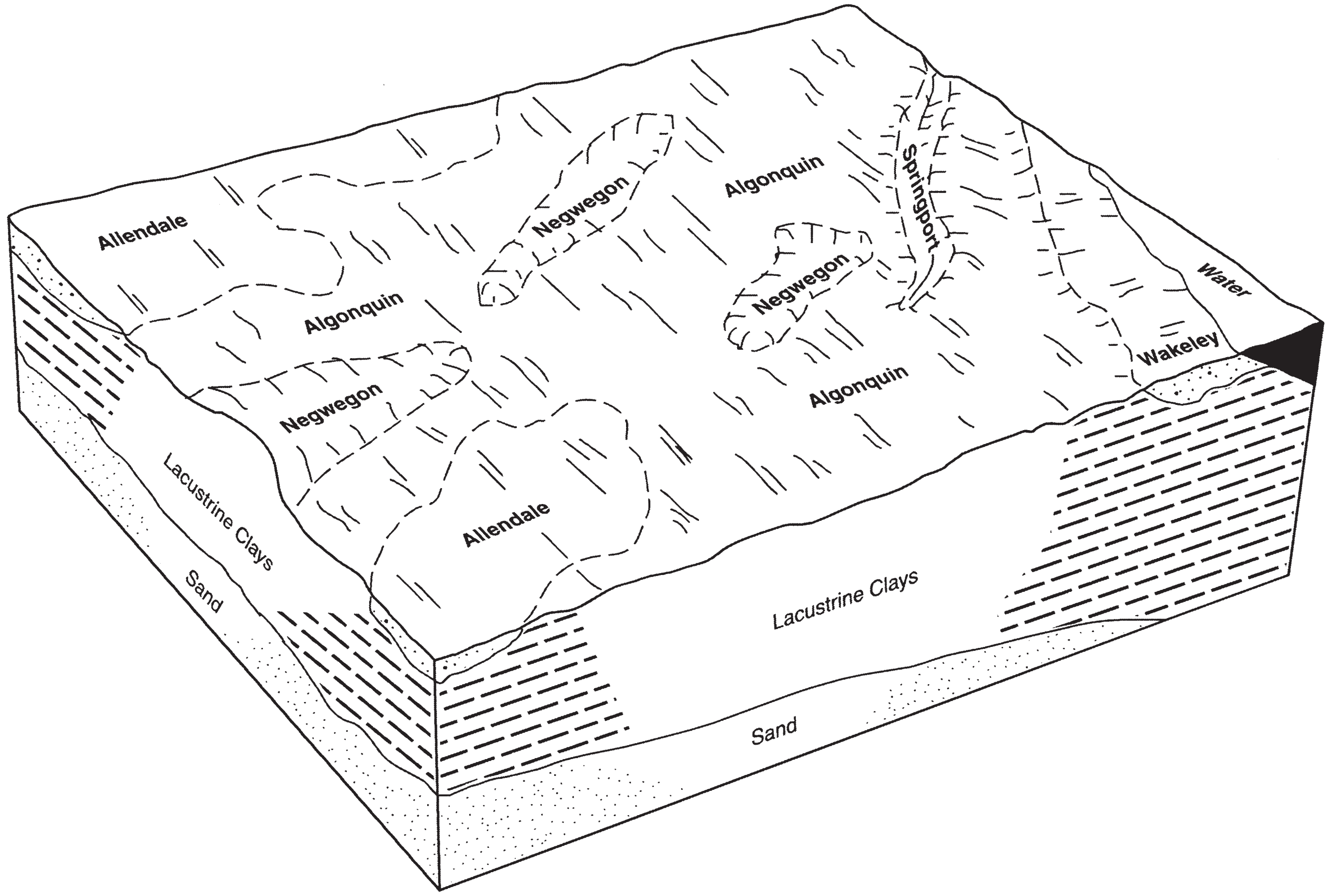


Figure 4.—Typical pattern of soils and parent material in the Algonquin-Allendale-Negwegon general soil map unit.

Composition

Extent of map unit in the survey area: 27 percent
Extent of the soils in the map unit:
Rubicon soils—58 percent
Grayling soils—13 percent
Croswell soils—6 percent
Minor soils—23 percent

Soil Properties and Qualities

Rubicon

Drainage class: Excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to strongly sloping

Grayling

Drainage class: Excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to strongly sloping

Croswell

Drainage class: Moderately well drained
Position on landform: Flats and low knolls
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level and gently undulating

Minor Soils

- Au Gres soils that are somewhat poorly drained, on toeslopes
- Ausable soils that are very poorly drained, on flood plains
- Roscommon soils that are very poorly drained, in depressions

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation, seedling mortality, and windthrow hazard

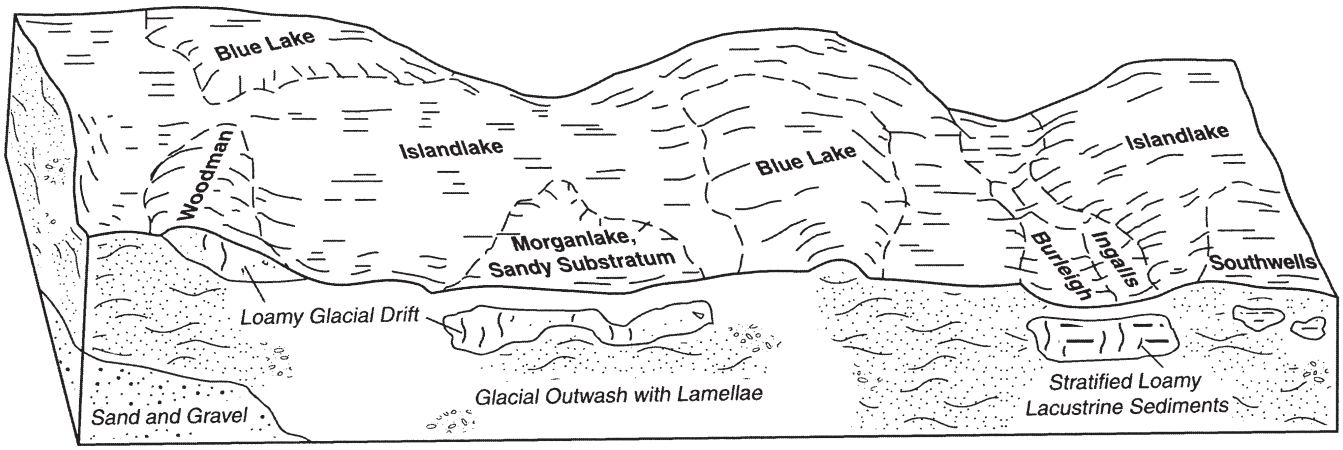


Figure 5.—Typical pattern of soils and parent material in the Islandlake-Blue Lake-Morganlake, sandy substratum, general soil map unit.

Management measures and considerations:
- Logging roads should be stabilized.
- Planting seedlings of special stock can reduce seedling mortality rates.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.

4. Islandlake-Blue Lake-Morganlake, sandy substratum

Nearly level to steep, somewhat excessively drained to well drained, sandy soils on moraines

Setting

Landform: Moraines (fig. 5)
Slope range: 0 to 35 percent

Composition

Extent of map unit in the survey area: 23 percent
Extent of the soils in the map unit:
Islandlake soils—58 percent
Blue Lake soils—15 percent
Morganlake soils—2 percent
Minor soils—25 percent

Soil Properties and Qualities

Islandlake

Drainage class: Somewhat excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to steep

Blue Lake

Drainage class: Well drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Loamy sand
Slope: Nearly level to steep

Morganlake

Drainage class: Moderately well drained
Position on landform: Flats, knolls, and ridges
Parent material: Loamy over sandy sediments
Surface textural class: Loamy sand
Slope: Nearly level to moderately sloping

Minor Soils

- Ingalls soils that are somewhat poorly drained, on toeslopes
- Burleigh soils that are poorly drained, in depressions and drainageways
- Southwells soils that are well drained and have loamy material between depths of 40 and 60 inches
- Woodman soils that have a loamy surface layer, on landforms similar to those of the Islandlake soils

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
- Logging roads should be stabilized.
- Planting seedlings of special stock can reduce seedling mortality rates.

• Site preparation by mechanical or chemical means is needed to control competing vegetation.

5. Kalkaska-Springlake-Southwells

Nearly level to very steep, somewhat excessively drained and well drained, sandy soils on moraines and outwash plains

Setting

Landform: Outwash plains and moraines
Slope range: 0 to 50 percent

Composition

Extent of map unit in the survey area: 16 percent
Extent of the soils in the map unit:
Kalkaska soils—51 percent
Springlake soils—18 percent
Southwells soils—16 percent
Minor soils—15 percent

Soil Properties and Qualities

Kalkaska

Drainage class: Somewhat excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to very steep

Springlake

Drainage class: Somewhat excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to steep

Southwells

Drainage class: Well drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to very steep

Minor Soils

• Au Gres soils that are somewhat poorly drained, on toeslopes
• Croswell soils that are moderately well drained, on low knolls

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Logging roads should be stabilized.
• Planting seedlings of special stock can reduce seedling mortality rates.

6. Croswell-Au Gres-Leafriver

Level to undulating, moderately well drained, somewhat poorly drained, and very poorly drained, sandy and mucky soils on outwash plains and lake plains

Setting

Landform: Lake plains and outwash plains (fig. 6)
Slope range: 0 to 3 percent

Composition

Extent of map unit in the survey area: 9 percent
Extent of the soils in the map unit:
Croswell soils—39 percent
Au Gres soils—28 percent
Leafriver soils—17 percent
Minor soils—16 percent

Soil Properties and Qualities

Croswell

Drainage class: Moderately well drained
Position on landform: Low knolls
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to undulating

Au Gres

Drainage class: Somewhat poorly drained
Position on landform: Swales and toeslopes
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to undulating

Leafriver

Drainage class: Very poorly drained
Position on landform: Depressions and drainageways
Parent material: Herbaceous material over sandy sediments
Surface textural class: Muck
Slope: Level

Minor Soils

• Rubicon soils that are excessively drained, on knolls
• Tawas soils that have 16 to 50 inches of muck, on slopes similiar to those of the Leafriver soils

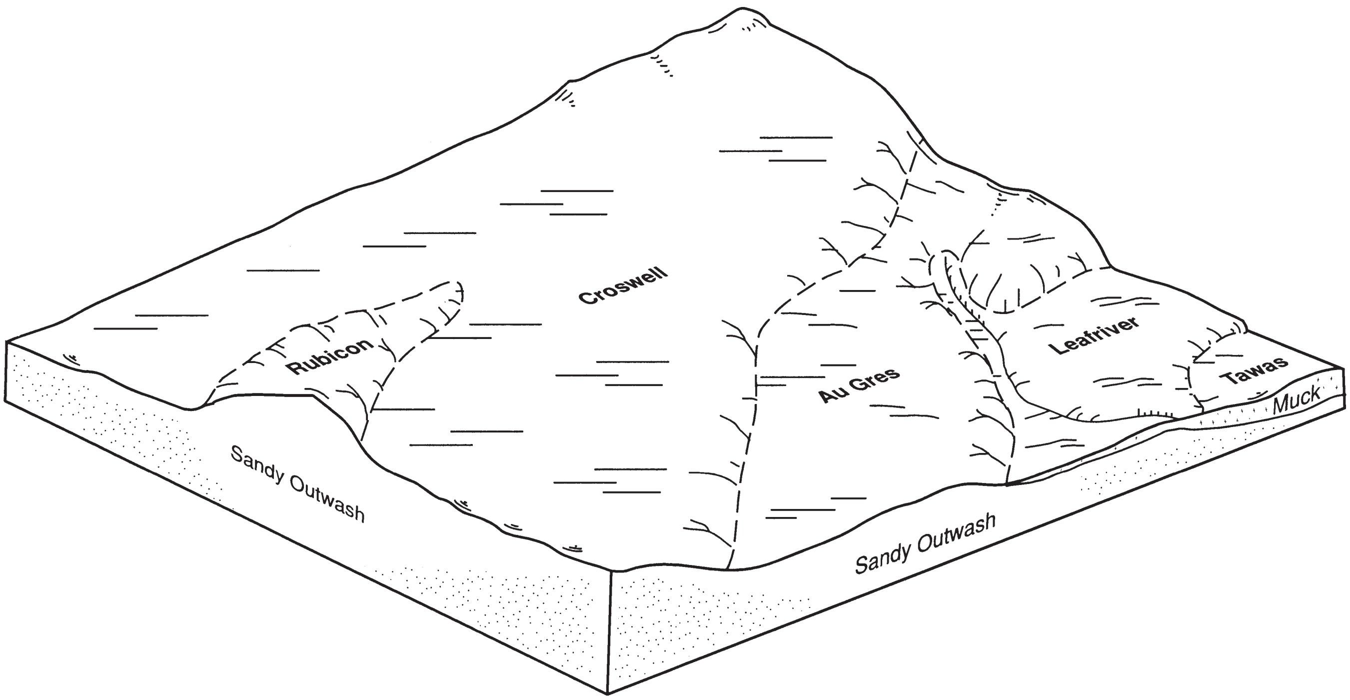


Figure 6.—Typical pattern of soils and parent material in the Croswell-Au Gres-Leafriver general soil map unit.

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
- Because of the wetness, access roads should be utilized only when frozen and harvesting methods should leave trees widely spaced.
- Trees should not be planted due to the wetness.
- Site preparation by mechanical or chemical means is needed to control competing vegetation.

7. Graycalm-Klacking-Rubicon

Nearly level to very steep, excessively drained to well drained, sandy soils on moraines and outwash plains

Setting

Landform: Outwash plains and moraines
Slope range: 0 to 45 percent

Composition

Extent of map unit in the survey area: 9 percent
Extent of the soils in the map unit:
Graycalm soils—47 percent
Klacking soils—11 percent
Rubicon soils—10 percent
Minor soils—32 percent

Soil Properties and Qualities

Graycalm

Drainage class: Somewhat excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to very steep

Klacking

Drainage class: Well drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy and loamy sediments
Surface textural class: Loamy sand
Slope: Nearly level to very steep

Rubicon

Drainage class: Excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Sand
Slope: Nearly level to very steep

Minor Soils

- Au Gres soils that are somewhat poorly drained, on toeslopes

• Croswell soils that are moderately well drained, on low knolls
• Lupton soils that are very poorly drained, in depressions

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Logging roads should be stabilized.
• Planting seedlings of special stock can reduce seedling mortality rates.

8. Islandlake

Nearly level to moderately sloping, somewhat excessively drained, sandy soils on outwash plains

Setting

Landform: Outwash plains
Slope range: 0 to 12 percent

Composition

Extent of map unit in the survey area: 9 percent
Extent of the soils in the map unit:
Islandlake soils—85 percent
Minor soils—15 percent

Soil Properties and Qualities

Drainage class: Somewhat excessively drained
Position on landform: Flats, knolls, and ridges
Parent material: Sandy sediments
Surface textural class: Loamy sand
Slope: Nearly level to moderately sloping

Minor Soils

• Blue Lake soils that are well drained, on slopes similiar to those of the Islandlake soils
• Halfaday soils that are moderately well drained, on the slightly lower landforms

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Logging roads should be stabilized.
• Planting seedlings of special stock can reduce seedling mortality rates.
• Site preparation by mechanical or chemical means is needed to control competing vegetation.

Broad Land Use Considerations

The general soil map can help planners of building site development, farming, recreation, and other uses on a county-wide scale. The general soil map is suitable for broad land use planning but is not suitable for selecting a site for a specific use.

The seasonal high water table in most areas of the Croswell-Au Gres-Leafriver, Algonquin-Allendale-Negwegon, and Lupton-Tawas-Roscommon general soil map units is a severe limitation for building site development. The slope in the rolling to very steep areas of the Graycalm-Klacking-Rubicon; Islandlake-Blue Lake-Morganlake, sandy substratum; Rubicon-Grayling-Croswell; and Kalkaska-Springlake-Southwells general soil map units also is a severe limitation for building site development.

Soils in the county that are suited to building site development include those in the less sloping areas of the Islandlake-Blue Lake-Morganlake, sandy substratum; Kalkaska-Springlake-Southwells; Rubicon-Grayling-Croswell; Islandlake; and Graycalm-Klacking-Rubicon general soil map units.

The somewhat excessively drained and well drained, gently rolling soils in the Islandlake-Blue Lake-Morganlake, sandy substratum; Islandlake; and Kalkaska-Springlake-Southwells general soil map units are farmed. The somewhat poorly drained soils of the Algonquin-Allendale-Negwegon general soil map unit are also farmed.

Most soils in the county are well suited or moderately well suited to woodland. The Rubicon-Grayling-Croswell and Kalkaska-Springlake-Southwells general soil map units contain the largest areas of woodland.

The major soils in the Rubicon-Grayling-Croswell, Graycalm-Klacking-Rubicon, and Kalkaska-Springlake-Southwells general soil map units are suited to recreational uses, such as off-road vehicle use, camping, hiking, cross-country skiing, and snow-mobiling.

The Lupton-Tawas-Roscommon general soil map unit is suited to wildlife habitat and provides good nature study areas.

Detailed Soil Map Units

The map units delineated on the detailed maps represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kalkaska sand, 0 to 6 percent slopes, severely eroded, is a phase of the Kalkaska series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Islandlake-Blue Lake complex, 0 to 6 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such

areas have little or no soil material and support little or no vegetation. Pits, borrow, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see “Contents”) give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

13—Tawas-Lupton mucks

Setting

Landform: Low flats, depressions, and drainageways on lake plains, outwash plains, and kame moraines
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 5 to 1,100 acres

Composition

Tawas soil and similar soils: 55 to 65 percent
Lupton soil and similar soils: 25 to 45 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Tawas

Surface layer:
0 to 7 inches—black muck

Subsoil:
7 to 21 inches—black friable muck
21 to 80 inches—brown sand

Lupton

Surface layer:
0 to 10 inches—black muck

Subsoil:
10 to 80 inches—black friable muck

Soil Properties and Qualities

Permeability: Tawas—moderately slow to moderately rapid in the organic material and rapid in the underlying sand; Lupton—moderately slow to moderately rapid
Available water capacity: Tawas—high; Lupton—very high
Drainage class: Very poorly drained
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils on the slightly higher landforms
• Kinross and Roscommon soils that have less than 6 inches of muck over sand, on landforms similar to those of the Tawas and Lupton soils
• Small areas of open water

Similar inclusions:
• Areas of Tawas soils that have thin layers of loamy material in the substratum
• Areas of Tawas soils where the muck layers are between 8 and 16 inches thick
• Areas of Tawas and Lupton soils that are very strongly acid in portions of the profile

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Because of the wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced.
• Because of the wetness, severe seedling mortality rates, and plant competition, trees are generally not planted on these soils.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings, so that woodland can naturally regenerate, is desirable.

Buildings

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding and low soil strength, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding

Management measures and considerations:
• Because of the ponding and low soil strength, these soils are generally unsuited to septic tank absorption fields and dwellings.

Interpretive Groups

Land capability classification: 6w
Woodland ordination symbol: Tawas—5W; Lupton—2W

14—Dawson-Loxley peats

Setting

Landform: Depressions and backswamps on lake plains, kame moraines, and outwash plains
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 3 to 300 acres

Composition

Dawson soil and similar soils: 45 to 50 percent
Loxley soil and similar soils: 40 to 50 percent
Contrasting inclusions: 0 to 15 percent

Typical Profile

Dawson

Surface layer:
0 to 4 inches—dark brown mucky peat

Subsoil:
4 to 20 inches—black and dark reddish brown friable muck

Substratum:
20 to 22 inches—black friable loam
22 to 80 inches—brown sand

Loxley

Surface layer:
0 to 12 inches—black mucky peat

Subsoil:
12 to 21 inches—black friable mucky peat
21 to 80 inches—black friable muck

Soil Properties and Qualities

Permeability: Dawson—moderately slow to moderately rapid in the mucky material and rapid in the sandy underlying material; Loxley—moderately slow to moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Kinross and Roscommon soils that have less than 16 inches of muck over sand, on landforms similar to those of the Dawxon and Loxley soils

Similar inclusions:
• Areas of Dawson soils that have a loamy substratum
• Areas of Loxley soils that have a thin layer of marl

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Because of the wetness and low soil strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Because of the wetness, seedling mortality, and plant competition, trees generally are not planted on these soils.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding and low soil strength, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding and low soil strength, these soils are generally unsuited to septic tank absorption fields and dwellings.

Interpretive Groups

Land capability classification: 7w
Woodland ordination symbol: 2W

15A—Croswell-Au Gres sands, 0 to 3 percent slopes

Setting

Landform: Flats, swales, and low knolls on lake plains, outwash plains, morainic remnants, and kame moraines
Shape of areas: Irregular or elongated
Size of areas: 5 to 100 acres

Composition

Croswell soil and similar soils: 50 to 60 percent
Au Gres soil and similar soils: 30 to 35 percent
Contrasting inclusions: 5 to 20 percent

Typical Profile

Croswell

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 8 inches—grayish brown sand

Subsoil:
8 to 32 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
32 to 80 inches—light yellowish brown and pale brown mottled sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 13 inches—dark reddish brown mottled very friable sand
13 to 24 inches—dark brown mottled loose sand

Substratum:
24 to 80 inches—yellowish brown, light yellowish brown, and light brownish gray mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Croswell—moderately well drained; Au Gres—somewhat poorly drained
Seasonal high water table: Croswell—at a depth of 2.0 to 3.5 feet from October to December and from March to June; Au Gres—at a depth of 0.5 foot to 1.5 feet from October to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Croswell—low; Au Gres—moderate

Inclusions

Contrasting inclusions:
- Excessively drained Rubicon soils on the higher landforms
- Somewhat excessively drained Lindquist, Islandlake, and Kalkaska soils on the higher landforms
- Very poorly drained Leafriver soils in depressions and drainageways

Similar inclusions:
- Areas of Au Gres soils where the subsoil is more than 50 percent cemented
- Areas of Croswell and Au Gres soils where the substratum is loamy at a depth of 40 to 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Croswell—cutbanks

cave and seasonal wetness; Au Gres—cutbanks cave, seasonal wetness, and frost action

Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.

Septic tank absorption fields

Major management concerns: Seasonal wetness and rapid permeability
Management measures and considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Croswell—4s; Au Gres—4w
Woodland ordination symbol: Croswell—5S; Au Gres—6W

16B—Graycalm sand, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on outwash plains
Shape of areas: Irregular
Size of areas: 5 to 1,780 acres

Composition

Graycalm soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—dark yellowish brown very friable sand
19 to 31 inches—very pale brown loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils on the lower landforms
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the accumulation of loamy lamellae is more than 6 inches
• Areas which are saturated below a depth of 60 inches
• Areas which are sandy throughout

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability

Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 6S

16E—Graycalm sand, 18 to 35 percent slopes

Setting

Landform: Ridgetops and escarpments on kame moraines, morainic remnants, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Composition

Graycalm soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—dark yellowish brown very friable sand
19 to 31 inches—very pale brown loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Klacking soils that are loamy, on landforms similar to those of the Graycalm soil

Similar inclusions:
• Areas where the subsoil is sandy throughout
• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 6R

17A—Croswell sand, 0 to 3 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, lake plains, kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular or elongated
Size of areas: 5 to 420 acres

Composition

Croswell soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 8 inches—grayish brown sand

Subsoil:
8 to 32 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
32 to 80 inches—light yellowish brown and pale brown mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet from October to December and from March to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Excessively drained Rubicon soils on similar or slightly higher landforms
- Somewhat excessively drained Islandlake, Kalkaska, and Lindquist soils on similar or slightly higher landforms

Similar inclusions:
- Areas where the substratum has thin layers of loamy sand
- Areas where the seasonal high water table is at a depth of 6 to 18 inches
- Areas where the seasonal high water table at a depth of 4 to 5 feet
- Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
- Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Because of the limited available water capacity, most crops should be irrigated.
- The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting in early spring and late fall when the soil is moist and using careful planting procedures can reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty

conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and seasonal wetness
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness and rapid permeability
Management measures and considerations:
• Filling or mounding with suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 5S

18A—Au Gres sand, 0 to 3 percent slopes

Setting

Landform: Flats, toeslopes, and swales on stream terraces, lake plains, outwash plains, morainic remnants, and kame moraines
Shape of areas: Irregular or elongated
Size of areas: 5 to 850 acres

Composition

Au Gres soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 13 inches—dark reddish brown mottled very friable sand
13 to 24 inches—dark brown mottled loose sand

Substratum:
24 to 80 inches—yellowish brown, light yellowish brown, and light brownish gray mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 0.5 foot to 1.5 feet from October to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Excessively drained Rubicon soils on the higher landforms
• Very poorly drained Kinross and Roscommon soils in drainageways and on low landforms

Similar inclusions:
• Areas where the subsoil is more than 50 percent cemented
• Areas where the substratum is loamy below a depth of 40 inches
• Areas where the seasonal high water table is at a depth of 2.0 to 3.5 feet

Use and Management

Land Use: Dominant uses—woodland and pasture; other uses—cropland and building site development

Cropland

Major management concerns: Seasonal wetness, available water capacity, soil blowing, and nutrient and pesticide loss
Management measures and considerations:
• Subsurface drains can reduce the wetness if a suitable outlet is available.

• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Droughtiness, soil blowing, and seasonal wetness
Management measures and considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• Trees that can withstand seasonal wetness should be selected for planting.
• Special harvesting methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness, and frost action
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.

Septic tank absorption fields

Major management concerns: Seasonal wetness and rapid permeability
Management measures and considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4w
Woodland ordination symbol: 6W

19—Leafriver muck

Setting

Landform: Flats, depressions, and drainageways on outwash plains, kame moraines, and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 330 acres

Composition

Leafriver soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 14 inches—black muck

Substratum:
14 to 80 inches—light brownish gray and brown sand

Soil Properties and Qualities

Permeability: Moderate or moderately rapid in the organic material and rapid in the sandy underlying material
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: None

Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Au Gres soils that are somewhat poorly drained, on the slightly higher landforms
• Kinross and Roscommon soils that have organic material less than 8 inches thick over sand, on landforms similar to those of the Leafriver soil

Similar inclusions:
• Areas where the soil is organic throughout
• Areas where the substratum is loamy
• Areas where the soil is flooded

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Because of the wetness and low soil strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Landing sites generally can be used only during the driest time of the year.
• Year-round logging roads require roadfill and gravel.
• Log landing sites should be located on drier, more suitable soils.
• Trees generally are not planted on this soil because of the wetness, seedling mortality, and plant competition.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• Special harvesting methods may be needed to control undesirable plants.

Buildings

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Woodland ordination symbol: 2W

20B—Graycalm-Grayling sands, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on remnant moraines, stream terraces, kame moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 725 acres

Composition

Graycalm soil and similar soils: 45 to 55 percent
Grayling soil and similar soils: 35 to 45 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Grayling

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable and loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Grayling—excessively drained
Seasonal high water table: At a depth of more than 6 feet

Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms
• Klacking soils that have a loamy subsoil, on landforms similar to those of the Graycalm and Grayling soils
• Very poorly drained Roscommon soils in depressions

Similar inclusions:
• Areas of Graycalm and Grayling soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Graycalm and Grayling soils that have a darker subsoil

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Graycalm—4s; Grayling—6s
Woodland ordination symbol: Graycalm—6S; Grayling—4S

20D—Graycalm-Grayling sands, 6 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on remnant moraines, stream terraces, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 525 acres

Composition

Graycalm soil and similar soils: 55 to 65 percent
Grayling soil and similar soils: 30 to 45 percent
Contrasting inclusions: 0 to 15 percent

Typical Profile

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Grayling

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Grayling—excessively drained

Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Klacking soils have a loamy subsoil, on landforms similar to those of the Graycalm and Grayling soils

Similar inclusions:
• Areas of Graycalm and Grayling soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Graycalm and Grayling soils that have a darker subsoil

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Graycalm—6s; Grayling—7s
Woodland ordination symbol: Graycalm—6S; Grayling—4S

20F—Graycalm-Grayling sands, 18 to 45 percent slopes

Setting

Landform: Escarpments, side slopes, and ridgetops on remnant moraines
Shape of areas: Elongated or irregular
Size of areas: 5 to 150 acres

Composition

Graycalm soil and similar soils: 60 to 75 percent
Grayling soil and similar soils: 20 to 40 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Grayling

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Grayling—excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Klacking soils that have a loamy subsoil, on landforms similar to those of the Graycalm and Grayling soils

Similar inclusions:
• Areas of Graycalm and Grayling soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Graycalm and Grayling soils that have a darker subsoil

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: Graycalm—6R; Grayling—4R

21B—Graycalm-Klacking complex, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 725 acres

Composition

Graycalm soil and similar soils: 45 to 55 percent
Klacking soil and similar soils: 35 to 50 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Klacking

Surface layer:
0 to 2 inches—very dark gray loamy sand

Subsoil:
2 to 21 inches—yellowish brown very friable loamy sand
21 to 33 inches—light yellowish brown very friable sand that has lamellae of strong brown loamy sand
33 to 51 inches—dark yellowish brown friable sandy loam surrounded by yellowish brown loamy sand
51 to 80 inches—very pale brown loose sand that has lamellae of strong brown loamy sand

Soil Properties and Qualities

Permeability: Graycalm—rapid; Klacking—moderately rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Klacking—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Graycalm—severe; Klacking—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms
• Grayling soils that are sandy throughout, on landforms similar to those of the Graycalm and Klacking soils
• Very poorly drained Roscommon soils in depressions

Similar inclusions:
• Areas of Graycalm and Klacking soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Graycalm and Klacking soils that have a darker subsoil

Use and Management

Land Use: Dominant uses—woodland and building site development; other uses—cropland and pasture

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Graycalm—equipment limitation and seedling mortality; Klacking—plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Graycalm soil
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Graycalm—4s; Klacking—3s
Woodland ordination symbol: 6S

21D—Graycalm-Klacking complex, 6 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on remnant moraines, kame moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 460 acres

Composition

Graycalm soil and similar soils: 45 to 50 percent
Klacking soil and similar soils: 40 to 50 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Klacking

Surface layer:
0 to 2 inches—very dark gray loamy sand

Subsoil:
2 to 21 inches—yellowish brown very friable loamy sand
21 to 33 inches—light yellowish brown very friable sand that has lamellae of strong brown loamy sand
33 to 51 inches—dark yellowish brown friable sandy loam surrounded by yellowish brown loamy sand
51 to 80 inches—very pale brown loose sand that has lamellae of strong brown loamy sand

Soil Properties and Qualities

Permeability: Graycalm—rapid; Klacking—moderately rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Klacking—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Graycalm—severe; Klacking—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Grayling soils that are sandy throughout, on landforms similar to those of the Graycalm and Klacking soils

Similar inclusions:
• Areas of Graycalm and Klacking soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Graycalm and Klacking soils that have a darker subsoil

Use and Management

Land Use: Dominant uses—woodland and building site development; other uses—cropland and pasture

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.

• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Graycalm—equipment limitation and seedling mortality; Klacking—plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Graycalm—rapid permeability and slope; Klacking—slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Graycalm—6s; Klacking—4e
Woodland ordination symbol: 6S

21F—Graycalm-Klacking complex, 18 to 45 percent slopes

Setting

Landform: Escarpments, side slopes, and ridgetops on remnant moraines and kame moraines
Shape of areas: Irregular
Size of areas: 10 to 460 acres

Composition

Graycalm soil and similar soils: 45 to 60 percent
Klacking soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Klacking

Surface layer:
0 to 2 inches—very dark gray loamy sand

Subsoil:
2 to 21 inches—yellowish brown very friable loamy sand
21 to 33 inches—light yellowish brown very friable sand that has lamellae of strong brown loamy sand

33 to 51 inches—dark yellowish brown friable sandy loam surrounded by yellowish brown loamy sand
51 to 80 inches—very pale brown loose sand that has lamellae of strong brown loamy sand

Soil Properties and Qualities

Permeability: Graycalm—rapid; Klacking—moderately rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Klacking—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Graycalm—severe; Klacking—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Grayling soils that are sandy throughout, on landforms similar to those of the Graycalm and Klacking soils

Similar inclusions:
• Areas of Graycalm and Klacking soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Graycalm and Klacking soils that have a darker subsoil

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Graycalm—erosion hazard, equipment limitation, and seedling mortality; Klacking—erosion hazard, equipment limitation, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Graycalm—slope and rapid permeability; Klacking—slope
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Graycalm—7s; Klacking—7e
Woodland ordination symbol: 6R

22B—Montcalm loamy sand, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on outwash plains
Shape of areas: Irregular
Size of areas: 125 to 975 acres

Composition

Montcalm soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 7 inches—dark grayish brown loamy sand

Subsurface layer:
7 to 10 inches—pale brown loamy sand

Subsoil:
10 to 23 inches—dark brown and yellowish brown very friable loamy sand
23 to 46 inches—brown very friable loamy sand mixed with dark yellowish brown friable sandy loam
46 to 80 inches—light yellowish brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Halfaday soils on the slightly lower landforms
• Hodenpyl soils that have more clay in the surface layer than the Montcalm soil, on similar landforms

Similar inclusions:
• Areas where the lower part of the subsoil has pockets of sand and gravel

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: 3s
Woodland ordination symbol: 3A

23—Ausable-Bowstring mucks, frequently flooded

Setting

Landform: Low flats and depressions along perennial rivers and creeks on flood plains
Shape of areas: Irregular or linear
Size of areas: 5 to 150 acres

Composition

Ausable soil and similar soils: 50 to 55 percent
Bowstring soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Ausable

Surface layer:
0 to 6 inches—black muck

Substratum:
6 to 11 inches—black muck

11 to 38 inches—light brownish gray sand
38 to 80 inches—grayish brown sand that has thin horizontal strata of very dark gray and black muck

Bowstring

Surface layer:
0 to 18 inches—black muck

Substratum:
18 to 21 inches—black muck
21 to 37 inches—black muck that has thin strata of light yellowish brown sand
37 to 47 inches—light brownish gray sand that has thin strata of black muck
47 to 80 inches—black muck that has thin strata of light brownish gray sand

Soil Properties and Qualities

Permeability: Ausable—moderate or moderately rapid; Bowstring—moderately slow to moderately rapid
Available water capacity: Ausable—moderate; Bowstring—very high
Drainage class: Very poorly drained
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: Ausable—frequent from November to May; Bowstring—frequent from March to June
Hazard of water erosion: Slight
Hazard of soil blowing: Ausable—moderate; Bowstring—slight
Shrink-swell potential: Low
Potential for frost action: Ausable—moderate; Bowstring—high

Inclusions

Contrasting inclusions:
• Winterfield soils that are somewhat poorly drained, on the slightly higher landforms

Similar inclusions:
• Areas of Bowstring soils that contain all organic material
• Areas of Bowstring soils where the subsoil has layers of marl

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Because of the wetness and low soil strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• Because of the wetness, severe seedling mortality, and plant competition, trees generally are not planted on these soils.

Buildings

Major management concerns: Seasonal flooding, ponding, and frost action
Management measures and considerations:
• Because of the flooding, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Seasonal flooding and ponding
Management measures and considerations:
• Because of the flooding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Ausable—7w; Bowstring—6w
Woodland ordination symbol: Ausable—2W; Bowstring—3W

24A—Kinross-Au Gres complex, 0 to 3 percent slopes

Setting

Landform: Flats, swales, and depressions on lake plains, outwash plains, remnant moraines, and kame moraines
Shape of areas: Irregular or elongated
Size of areas: 5 to 120 acres

Composition

Kinross soil and similar soils: 40 to 60 percent
Au Gres soil and similar soils: 30 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Kinross

Surface layer:
0 to 2 inches—black muck

Subsurface layer:
2 to 20 inches—grayish brown and light grayish brown mottled sand

Subsoil:
20 to 48 inches—dark brown mottled loose sand

Substratum:
48 to 80 inches—yellowish brown mottled sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 13 inches—dark reddish brown mottled very friable sand
13 to 24 inches—dark brown mottled loose sand

Substratum:
24 to 80 inches—yellowish brown, light yellowish brown, and light brownish gray mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Kinross—very poorly drained; Au Gres—somewhat poorly drained
Seasonal high water table: Kinross—1 foot above to 0.5 foot below the surface from September to June; Au Gres—at a depth of 0.5 foot to 1.5 feet from October to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Kinross—moderate; Au Gres—severe
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Leafriver, Lupton, and Dawson soils that have 8 or more inches of muck, on landforms similar to those of the Kinross soil

Similar inclusions:
• Areas of Kinross and Au Gres soils where the subsoil is more than 50 percent cemented
• Areas of Au Gres soils where the substratum is loamy below a depth of 40 inches
• Areas of Au Gres soils where the seasonal high water table is at a depth of 2.0 to 3.5 feet

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Kinross—cutbanks cave, seasonal wetness, frost action, and ponding; Au Gres—cutbanks cave, seasonal wetness, and frost action
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.
• Because of the ponding, the Kinross soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Kinross—seasonal wetness, rapid permeability, and ponding;

Au Gres—seasonal wetness and rapid permeability

Management measures and considerations:

• Mounding or adding suitable fill material helps to raise the absorption field above the water table.

• The poor filtering capacity of the soils can result in the pollution of ground water.

• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

• Because of the ponding, the Kinross soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Kinross—6w; Au Gres—4w

Woodland ordination symbol: Kinross—2W; Au Gres—6W

26B—Cublake sand, 0 to 6 percent slopes

Setting

Landform: Flat or low knolls on outwash plains, lake plains, kame moraines, and stream terraces

Shape of areas: Irregular or elongated

Size of areas: 5 to 420 acres

Composition

Cublake soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:

0 to 4 inches—very dark gray sand

Subsurface layer:

4 to 8 inches—brown sand

Subsoil:

8 to 31 inches—brown, strong brown, and yellowish brown very friable and loose sand

Substratum:

31 to 56 inches—light yellowish brown mottled sand

56 to 80 inches—stratified gray and brown sandy clay loam and loamy sand

Soil Properties and Qualities

Permeability: Rapid in the sandy material and slow in the loamy material

Available water capacity: Low

Drainage class: Moderately well drained

Seasonal high water table: At a depth of 2.0 to 3.5 feet from October to December and from March to June

Surface runoff: Negligible

Flooding: None

Hazard of water erosion: Slight

Hazard of soil blowing: Severe

Shrink-swell potential: Low

Potential for frost action: Low

Inclusions

Contrasting inclusions:

• Ingalls and Burleigh soils that have a stratified loamy substratum at a depth of 20 to 40 inches, in swales and drainageways

• Excessively drained Rubicon soils on similar or slightly higher landforms

Similar inclusions:

• Areas where the substratum is at a depth of 60 to 80 inches

• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss

Management measures and considerations:

• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.

• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.

• Because of the limited available water capacity, most crops should be irrigated.

• The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.

• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing

Management measures and considerations:

• Proper stocking rates, controlled grazing, and

restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and seasonal wetness
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness and rapid permeability
Management measures and considerations:
• Filling or mounding with suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 7A

28B—East Lake sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 5 to more than 550 acres

Composition

East Lake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 1 inch—black decomposed forest litter

Subsurface layer:
1 to 3 inches—dark grayish brown sand

Subsoil:
3 to 26 inches—dark brown and strong brown very friable and loose sand
26 to 28 inches—very dark gray very friable gravelly loamy sand

Substratum:
28 to 80 inches—light yellowish brown stratified sand and gravel

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Very poorly drained Roscommon soils in depressions and drainageways

Similar inclusions:
• Areas where the soil is saturated at a depth of 60 to more than 80 inches
• Areas where the upper part of the subsoil is darker
• Areas where the substatum has less than 15 percent gravel

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.

• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 2S

32B—Kellogg sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on lake plains
Shape of areas: Irregular
Size of areas: 3 to 125 acres

Composition

Kellogg soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 9 inches—dark brown sand

Subsoil:
9 to 17 inches—dark brown and brown very friable sand
17 to 32 inches—brown and strong brown mottled very friable sand
32 to 40 inches—dark brown silty clay loam mixed with pale brown mottled firm loamy sand
40 to 60 inches—dark brown mottled firm silty clay loam

Substratum:
60 to 80 inches—dark yellowish brown silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and slow in the clayey underlying material
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.5 to 3.5 feet from September to November and from March to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low in the sandy material and high in the clayey underlying material
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Negwegon soils that have a loamy surface layer, on landforms similar to those of the Kellogg soil
• Somewhat poorly drained Allendale soils on toeslopes and in swales on the slightly lower landforms

Similar inclusions:
• Areas where the substratum has less clay

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
• Leaving crop residue on the surface and adding other organic material conserve moisture.
• Timing fertilizer applications to meet crop nutrient needs, using split applications of fertilizer, and applying fertilizer in bands may reduce the risk of nutrient leaching.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates and short-duration grazing

during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting in early spring and late fall when the soil is moist and using careful planting procedures can reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: High shrink-swell potential in the lower part of the subsoil and in the substratum, cutbanks cave, and frost action
Management measures and considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
• Caving of cutbanks is a concern for shallow excavations. Trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil, slow permeability in the lower part of the subsoil and in the substratum, high shrink-swell potential in the lower part of the subsoil and in the substratum, and seasonal high water table
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• Backfilling the trenches with porous material helps to compensate for the restricted permeability.
• A subsurface drainage system helps to lower the water table.

Interpretive Groups

Land capability classification: 3s
Woodland ordination symbol: 3S

35—Kinross muck

Setting

Landform: Flats, drainageways, and depressions on outwash plains, morainic remnants, kame moraines, and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 5 to 35 acres

Composition

Kinross soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 2 inches—black muck

Subsurface layer:
2 to 20 inches—grayish brown and light grayish brown mottled sand

Subsoil:
20 to 48 inches—dark brown mottled loose sand

Substratum:
48 to 80 inches—yellowish brown mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres and Finch soils on the slightly higher landforms
• Dawson and Loxley soils that have a muck surface layer more than 8 inches thick, on landforms similar to those of the Kinross soil

Similar inclusions:
• Areas where the subsoil is 50 percent or more cemented
• Areas where the surface layer is sand

Use and Management

Land Use: Dominant uses—woodland

Woodland

Management measures and considerations:
Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Skidders should not be used during wet periods, when ruts form easily.
• Equipment should be used only when the soil is relatively dry or has adequate snow cover.
• Because of the wetness and severe seedling mortality rate, trees generally are not planted on this soil.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Ponding, cutbanks cave, and frost action
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding and rapid permeability
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Woodland ordination symbol: 2W

47D—Graycalm sand, 6 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 125 acres

Composition

Graycalm soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Klacking soils that have a loamy subsoil, on landforms similar to those of the Graycalm soil

Similar inclusions:
• Areas where the subsoil has thin layers of calcareous gravel below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring

and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 6S

48B—Rubicon-Graycalm sands, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 725 acres

Composition

Rubicon soil and similar soils: 45 to 60 percent
Graycalm soil and similar soils: 35 to 50 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Rubicon

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Graycalm—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms
• Klacking soils that have a loamy subsoil, on landforms similar to those of the Rubicon and Graycalm soils
• Very poorly drained Roscommon soils in depressions

Similar inclusions:
• Areas of Rubicon and Graycalm soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Rubicon—6s; Graycalm—4s
Woodland ordination symbol: Rubicon—4S; Graycalm—6S

48D—Rubicon-Graycalm sands, 6 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 725 acres

Composition

Rubicon soil and similar soils: 55 to 65 percent
Graycalm soil and similar soils: 30 to 40 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Rubicon

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Graycalm—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Klacking soils that have a loamy subsoil, on landforms similar to those of the Rubicon and Graycalm soils

Similar inclusions:
• Areas of the Rubicon and Graycalm soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Rubicon—7s; Graycalm—6s
Woodland ordination symbol: Rubicon—4S; Graycalm—6S

48E—Rubicon-Graycalm sands, 18 to 35 percent slopes

Setting

Landform: Escarpments, side slopes, and ridgetops on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 435 acres

Composition

Rubicon soil and similar soils: 45 to 70 percent
Graycalm soil and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Rubicon

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Graycalm

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 19 inches—strong brown and dark yellowish brown very friable sand
19 to 31 inches—pale yellow loose sand
31 to 80 inches—very pale brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Graycalm—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Klacking soils that have a loamy subsoil, on landforms similar to those of the Rubicon and Graycalm soils

Similar inclusions:
• Areas of Rubicon and Graycalm soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: Rubicon—4R; Graycalm—6R

49B—Kalkaska sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, remnant moraines, stream terraces, and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 1,600 acres

Composition

Kalkaska soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 6 inches—dark reddish brown very friable sand
6 to 50 inches—dark brown, strong brown, and yellowish brown very friable sand

Substratum:
50 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the surface layer is severely eroded
• Areas where the subsoil has bands of loamy sand
• Areas where the substratum has bands of gravelly sand

Figure 7.—A Christmas tree plantation on Kalkaska sand, 0 to 6 percent slopes.

• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland (fig. 7); other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing

Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 3S

49B3—Kalkaska sand, 0 to 6 percent slopes, severely eroded

Setting

Landform: Low knolls on outwash plains, kame moraines, and old beach ridges
Shape of areas: Irregular
Size of areas: 5 to 120 acres

Composition

Kalkaska soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Subsoil:
0 to 50 inches—dark brown and brownish yellow loose sand

Substratum:
50 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Very poorly drained Roscommon soils and Histosols and Aquents that are ponded in depressions

Similar inclusions:
• Areas of soils that have a surface layer
• Areas where the substratum has layers of fine sand

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Caving of cutbanks is a concern for shallow excavations. Trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 3S

49C—Kalkaska sand, 6 to 12 percent slopes

Setting

Landform: Knolls and low ridges on kame moraines, remnant moraines, stream terraces, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 780 acres

Composition

Kalkaska soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 1 inch—dark reddish brown sand

Subsurface layer:
1 to 4 inches—reddish gray sand

Subsoil:
4 to 6 inches—dark reddish brown very friable sand
6 to 50 inches—dark brown, strong brown, and yellowish brown very friable sand

Substratum:
50 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the surface layer is severely eroded
• Areas where the subsoil has bands of loamy sand
• Areas where the substratum has bands of gravelly sand
• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, water erosion, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality

Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 3S

49D—Kalkaska sand, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 157 acres

Composition

Kalkaska soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 1 inch—dark reddish brown sand

Subsurface layer:
1 to 4 inches—reddish gray sand

Subsoil:
4 to 6 inches—dark reddish brown very friable sand
6 to 50 inches—dark brown, strong brown, and yellowish brown very friable sand

Substratum:
50 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the surface layer is severely eroded
• Areas where the subsoil has bands of loamy sand
• Areas where the substratum has bands of gravelly sand
• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Slope, soil blowing, seasonal droughtiness, water erosion, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.

• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 3S

49E—Kalkaska sand, 18 to 35 percent slopes

Setting

Landform: Escarpments, side slopes, and ridgetops on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 120 acres

Composition

Kalkaska soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Surface layer:
0 to 1 inch—dark reddish brown sand

Subsurface layer:
1 to 4 inches—reddish gray sand

Subsoil:
4 to 6 inches—dark reddish brown very friable sand
6 to 50 inches—dark brown, strong brown, and yellowish brown very friable sand

Substratum:
50 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Mancelona soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Kalkaska soil

Similar inclusions:
• Areas where the subsoil has bands of loamy sand
• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is poorly suited to building sites without extensive land shaping.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 3R

50B—Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes

Setting

Landform: Flats, swales, low knolls, and depressions on lake plains, outwash plains, remnant moraines, and kame moraines
Shape of areas: Irregular or elongated
Size of areas: 5 to 120 acres

Composition

Au Gres soil and similar soils: 30 to 50 percent
Kinross soil and similar soils: 20 to 35 percent
Croswell soil and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 13 inches—dark reddish brown mottled very friable sand
13 to 24 inches—dark brown mottled loose sand

Substratum:
24 to 80 inches—yellowish brown, light yellowish brown, and light brownish gray mottled sand

Kinross

Surface layer:
0 to 2 inches—black muck

Subsurface layer:
2 to 20 inches—grayish brown and light grayish brown mottled sand

Subsoil:
20 to 48 inches—dark brown mottled loose sand

Substratum:
48 to 80 inches—yellowish brown mottled sand

Croswell

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 8 inches—grayish brown sand

Subsoil:
8 to 32 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
32 to 80 inches—light yellowish brown and pale brown mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Au Gres—somewhat poorly drained; Kinross—very poorly drained; Croswell—moderately well drained
Seasonal high water table: Au Gres—at a depth of 0.5 foot to 1.5 feet from October to June; Kinross—1.0 foot above to 0.5 foot below the surface from September to June; Croswell—at a depth of 2.0 to 3.5 feet from October to December and from March to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Au Gres and Croswell—severe; Kinross—moderate
Shrink-swell potential: Low
Potential for frost action: Au Gres—moderate; Kinross—high; Croswell—low

Inclusions

Contrasting inclusions:
• Excessively drained Grayling and Rubicon soils on the higher landforms
• Leafriver and Dawson soils that have a mucky surface layer more than 8 inches thick, on landforms similar to those of the Kinross soil

Similar inclusions:
• Areas where the subsoil is more than 50 percent cemented
• Areas of Croswell soils where the substratum is loamy below a depth of 40 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Au Gres and Croswell—cutbanks cave, seasonal wetness, and frost action; Kinross—cutbanks cave, seasonal wetness, frost action, and ponding
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.
• Because of the ponding, the Kinross soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Au Gres and Croswell—seasonal wetness and rapid permeability; Kinross—seasonal wetness, rapid permeability, and ponding
Management measures and considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Because of the ponding, the Kinross soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Au Gres—4w; Kinross—6w; Croswell—4s

Woodland ordination symbol: Au Gres—6W; Kinross—2W; Croswell—5S

51—Tawas-Leafriver mucks

Setting

Landform: Low flats, depressions, and drainageways on outwash plains, kame moraines, and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 330 acres

Composition

Tawas soil and similar soils: 40 to 55 percent
Leafriver soil and similar soils: 30 to 50 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Tawas

Surface layer:
0 to 7 inches—black muck

Subsoil:
7 to 21 inches—black friable muck

Substratum:
21 to 80 inches—brown sand

Leafriver

Surface layer:
0 to 14 inches—black muck

Substratum:
14 to 80 inches—light brownish gray and brown sand

Soil Properties and Qualities

Permeability: Tawas—moderately slow to moderately rapid in the organic material and rapid in the sandy underlying material; Leafriver—moderate or moderately rapid in the organic material and rapid in the sandy underlying material
Available water capacity: Tawas—high; Leafriver—low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Au Gres soils that are somewhat poorly drained, on the slightly higher landforms
• Kinross and Roscommon soils that have organic material less than 8 inches thick over sand, on landforms similar to those of the Tawas and Leafriver soils

Similar inclusions:
• Areas of Tawas and Leafriver soils that are organic throughout
• Areas of Tawas soils that have a loamy substratum
• Areas of Tawas and Leafriver soils that are flooded

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Because of the wetness and low soil strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Landing sites generally can be used only during the driest time of the year.
• Year-round logging roads require roadfill and gravel.
• Log landing sites should be located on drier, more suitable soils.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• Trees generally are not planted on these soils because of the wetness, seedling mortality rate, and plant competition.

Buildings

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management measures and considerations:
• Because of the ponding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w

Woodland ordination symbol: Tawas—5W; Leafriver—2W

53B—Negwegon silt loam, 2 to 6 percent slopes

Setting

Landform: Low knolls on lake plains
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Composition

Negwegon soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 6 inches—dark grayish brown silt loam

Subsoil:
6 to 16 inches—dark brown silty clay that is mixed with light gray mottled firm silt loam
16 to 25 inches—dark brown firm silty clay

Substratum:
25 to 80 inches—stratified light olive brown, light brownish gray, and light yellowish brown silty clay loam and silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: At a depth of 1.0 to 3.0 feet from September to October and from March to May
Surface runoff: Very high
Flooding: None
Hazard of soil blowing: Slight
Shrink-swell potential: High
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
- Somewhat poorly drained Allendale and Algonquin soils on toeslopes and in swales on the lower landforms
- Poorly drained Springport soils in depressions and drainageways

Similar inclusions:
- Areas where the substratum is sandy below a depth of 60 inches
- Areas where the subsoil has less clay
- Areas where the surface layer is moderately eroded

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, very slow permeability, soil compaction, and tilth of the surface layer
Management measures and considerations:
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion and prevent crusting during periods of heavy rainfall and increases the rate of water infiltration.
- Subsurface drains can improve drainage in low areas.
- Because of the very slow permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly minimize the loss of dissolved and particulate nitrogen and phosphorus by reducing runoff losses.

Pasture

Major management concerns: Seasonal wetness, compaction, and overgrazing
Management measures and considerations:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, and plant competition
Management measures and considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Because of low soil strength, suitable surfacing material is needed on year-round logging roads and landings.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced

and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Seasonal high water table, shrink-swell potential, and frost action
Management measures and considerations:
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.

Septic tank absorption fields

Major management concerns: Seasonal high water table and very slow permeability
Management measures and considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• A subsurface drainage system helps to lower the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: 3e
Woodland ordination symbol: 3L

53C—Negwegon silt loam, 6 to 12 percent slopes

Setting

Landform: Knolls and ridges on lake plains
Shape of areas: Irregular
Size of areas: 3 to 56 acres

Composition

Negwegon soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 6 inches—dark grayish brown silt loam

Subsoil:
6 to 16 inches—dark brown silty clay that is mixed with light gray mottled firm silt loam
16 to 25 inches—dark brown firm silty clay

Substratum:
25 to 80 inches—stratified light olive brown, light brownish gray, and light yellowish brown silty clay loam and silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: At a depth of 1.0 to 3.0 feet from September to October and from March to May
Surface runoff: Very high
Flooding: None
Hazard of soil blowing: Slight
Shrink-swell potential: High
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Algonquin soils on toeslopes and in swales in the lower landscape positions

Similar inclusions:
• Areas where the substratum is sandy below a depth of 60 inches
• Areas where the subsoil has less clay
• Areas where the surface layer is moderately eroded

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, very slow permeability, soil compaction, and tilth of the surface layer
Management measures and considerations:
• A system of conservation tillage that leaves crop residue on the surface helps to control water erosion and prevent crusting during periods of heavy rainfall and increases the rate of water infiltration.
• Subsurface drains can improve drainage in low areas.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly minimize the loss of dissolved and

particulate nitrogen and phosphorus by reducing runoff losses.

Pasture

Major management concerns: Seasonal wetness, compaction, and overgrazing
Management measures and considerations:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, and plant competition
Management measures and considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Because of low soil strength, suitable surfacing material is needed on year-round logging roads and landings.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Seasonal high water table, shrink-swell potential, frost action, and slope
Management measures and considerations:
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Seasonal high water table, very slow permeability, and slope
Management measures and considerations:
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Woodland ordination symbol: 3L

54A—Algonquin silt loam, 0 to 3 percent slopes

Setting

Landform: Swales and toeslopes on lake plains
Shape of areas: Irregular
Size of areas: 3 to 75 acres

Composition

Algonquin soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 9 inches—very dark gray silt loam

Subsoil:
9 to 36 inches—dark yellowish brown and reddish brown mottled firm silty clay
36 to 80 inches—reddish brown mottled firm clay

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 0.5 foot to 1.5 feet from October to May
Surface runoff: High
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: High
Potential for frost action: High

Inclusions

Contrasting inclusions:
- Allendale soils that have a sandy surface layer, on landforms similar to those of the Algonquin soil
- Poorly drained Springport soils in depressions and drainageways

• Moderately well drained Negwegon soils on the higher landforms

Similar inclusions:
• Areas where the subsoil has less clay
• Areas where the substratum is sandy below a depth of 60 inches

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Seasonal wetness, water erosion, very slow permeability, soil compaction, and tilth of the surface layer
Management measures and considerations:
• Both surface and subsurface drainage systems are needed to reduce the wetness.
• A system of conservation tillage that leaves crop residue on the surface helps to control water erosion and prevent crusting during periods of heavy rainfall and increases the rate of water infiltration.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly minimize the loss of dissolved and particulate nitrogen and phosphorus by reducing runoff losses.

Pasture

Major management concerns: Seasonal wetness, compaction, and overgrazing
Management measures and considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Seasonal high water table, high shrink-swell potential, and frost action
Management measures and considerations:
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.

Septic tank absorption fields

Major management concerns: Seasonal high water table and very slow permeability
Management measures and considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• A subsurface drainage system helps to lower the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: 3w
Woodland ordination symbol: 6W

58A—Wakeley-Allendale complex, 0 to 3 percent slopes

Setting

Landform: Flats, swales, and depressions on lake plains
Shape of areas: Irregular or elongated
Size of areas: 5 to 100 acres

Composition

Wakeley soil and similar soils: 45 to 60 percent
Allendale soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Wakeley

Surface layer:
0 to 7 inches—black muck

Substratum:
7 to 22 inches—dark grayish brown, light olive brown, and light yellowish brown mottled sand
22 to 80 inches—yellowish brown and brown very firm silty clay

Allendale

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 10 inches—brown sand

Subsoil:
10 to 22 inches—dark brown mottled very friable sand
22 to 80 inches—brown mottled very firm silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy material and very slow in the clayey underlying material
Available water capacity: Moderate
Drainage class: Wakeley—very poorly drained; Allendale—somewhat poorly drained
Seasonal high water table: Wakeley—1.0 foot above to 1.0 foot below the surface from September to May; Allendale—at a depth of 0.5 foot to 1.5 feet from September to June
Surface runoff: Wakeley—low; Allendale—very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Wakeley—moderate; Allendale—severe
Shrink-swell potential: Low in the sandy part and high in the clayey part
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Burleigh soils that have a stratified substratum, in depressions and drainageways in landscape positions similar to those of the Wakeley soil
• Ingalls soils that are somewhat poorly drained and stratified in the substratum, on landforms similar to those of the Allendale soil
• Moderately well drained Kellogg soils on the higher landforms
• Springport soils that are clayey throughout, in depressions and drainageways on landforms similar to those of the Wakeley soil

Similar inclusions:
• Areas of Allendale soils where the subsoil is more than 50 percent cemented
• Areas of Wakeley soils where the surface layer has 8 to 16 inches of muck

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Wakeley—cutbanks cave, seasonal wetness, high shrink-swell potential in the lower part of the subsoil and in the substratum, frost action, and ponding; Allendale—cutbanks cave, seasonal wetness, high shrink-swell potential in the lower part of the subsoil and in the substratum, and frost action
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
• Because of the ponding, the Wakeley soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Wakeley—seasonal

wetness, rapid permeability in the sandy part, very slow permeability in the clayey part, and ponding; Allendale—seasonal wetness, rapid permeability in the sandy part, and very slow permeability in the clayey part

Management measures and considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Backfilling the trenches with porous material helps to compensate for the restricted permeability.
• Because of the ponding, the Wakeley soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Wakeley—5w; Allendale—3w
Woodland ordination symbol: Wakeley—3W; Allendale—4W

75B—Rubicon sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 1,000 acres

Composition

Rubicon soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres and Finch soils in the lower landscape positions
• Moderately well drained Croswell soils on the slightly lower landforms
• Very poorly drained Kinross and Roscommon soils in depressions and drainageways

Similar inclusions:
• Areas where the subsoil has bands of loamy sand
• Areas where the soil is saturated at a depth of 60 to more than 80 inches
• Areas where the substratum has thin bands of gravelly sand
• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 4S

75D—Rubicon sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on stream terraces, remnant moraines, outwash plains, and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Composition

Rubicon soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the subsoil has bands of loamy sand
• Areas where the soil is saturated at a depth of 60 to more than 80 inches
• Areas where the substratum has thin bands of gravelly sand
• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 4S

75E—Rubicon sand, 18 to 35 percent slopes

Setting

Landform: Ridgetops and escarpments on kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Composition

Rubicon soil and similar soils: 100 percent

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Similar inclusions:
• Areas where the subsoil has loamy sand lamellae
• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 4R

78—Pits, borrow

Setting

Shape of areas: Irregular
Size of areas: 3 to 10 acres

Composition

Pits: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• Areas of Udorthents or Udipsamments where regrowth of some vegetation has occurred
• Springlake soils that have a surface layer, along the edges of the active pit areas

Use and Management

Land Use: Source of sand, gravel, or fill material
Management measures and considerations:
• Onsite investigation is needed to determine the suitability of this map unit for specific uses.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned

81B—Grayling sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, remnant moraines, kame moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 50 to more than 1,000 acres

Composition

Grayling soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable and loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Very poorly drained Roscommon soils in depressions
• Klacking soils that have loamy bands accumulating to more than 6 inches in thickness in the subsoil, on landforms similar to those of the Grayling soil

Similar inclusions:
• Areas where the subsoil has bands of loamy sand accumulating to less than 6 inches in thickness
• Areas where the upper part of subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.

• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 4S

81D—Grayling sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on outwash plains, remnant moraines, kame moraines, and stream terraces
Shape of areas: Irregular or elongated
Size of areas: 5 to 560 acres

Composition

Grayling soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable and loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Klacking soils that have loamy bands accumulating to more than 6 inches in thickness in the subsoil, on landforms similar to those of the Grayling soil

Similar inclusions:
• Areas where the substratum has bands of loamy sand
• Areas that have bands of fine sand or gravelly sand in the subsoil or substratum
• Areas that have free carbonates in the substratum
• Areas where the upper part of subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 4S

81E—Grayling sand, 18 to 35 percent slopes

Setting

Landform: Escarpments and ridgetops on stream terraces, kame moraines, and remnant moraines
Shape of areas: Elongated
Size of areas: 5 to 50 acres

Composition

Grayling soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable and loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Klacking soils have loamy bands accumulating to more than 6 inches in thickness in the subsoil, on landforms similar to those of the Grayling soil

Similar inclusions:
• Areas where the substratum has bands of loamy sand
• Areas that have bands of fine sand or gravelly sand in the subsoil or substratum
• Areas that have free carbonates in the substratum
• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, and seedling mortality
Management measures and considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 4R

81F—Grayling sand, 18 to 45 percent slopes

Setting

Landform: Hills and ridges on outwash plains, kames, and moraines

Shape of areas: Irregular or linear
Size of areas: 5 to 50 acres

Composition

Grayling soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 30 inches—dark brown and brownish yellow very friable and loose sand

Substratum:
30 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Klacking soils that have loamy bands accumulating to more than 6 inches in thickness in the subsoil, on landforms similar to those of the Grayling soil

Similar inclusions:
- Areas where the substratum has bands of loamy sand
- Areas that have bands of gravelly sand in the substratum
- Areas that have free carbonates in the substratum
- Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, and seedling mortality
Management measures and considerations:
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
- Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope
Management measures and considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management measures and considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 4R

83B—Udipsamments, nearly level and undulating

Setting

Landform: Disturbed areas that formerly were excavated for borrow material and that have been filled on outwash plains, moraines, and lake plains
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Composition

Udipsamments and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Substratum:
0 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained or somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Small areas of undisturbed soils
- Soils that have a surface layer of sandy loam

Similiar inclusions:
- Soils that have a surface layer of loamy sand
- Soils that have thin bands of loamy sand, sandy loam, or gravelly sand below the surface layer

Use and Management

Land Use: Former use—woodland; current use—idle land or military training areas
Management measures and considerations:
- Onsite investigation is needed to determine the suitability of this map unit for specific uses.
- This map unit consists of sandy areas where the surface layer and portions of the subsoil have been removed or disturbed. In some areas, the original soil has been covered with sandy fill material. Most areas are barren or sparsely vegetated.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned

83F—Udipsamments, nearly level to very steep

Setting

Landform: Disturbed areas that formerly were excavated for borrow material and that have been filled on outwash plains, remnant moraines, kame moraines, lake plains, and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Composition

Udipsamments and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Substratum:
0 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Small undisturbed areas of Springlake soils

Similiar inclusions:
- Soils that have thin bands of loamy sand below the surface layer

Use and Management

Land Use: Former use—woodland; current use—idle land
Management measures and considerations:
- Onsite investigation is needed to determine the suitability of this map unit for specific uses.
- This map unit consists of sandy areas where the surface layer and portions of the subsoil have been removed or disturbed. In some areas, the original soil has been covered with sandy fill material. Most areas are barren or sparsely vegetated.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned

86—Histosols and Aquents, ponded

Setting

Landform: Depressions on kame moraines, remnant moraines, and outwash plains

Slope: 0 to 2 percent
Shape of areas: Elongated or irregular
Size of areas: 5 to 100 acres

Composition

Histosols and similar soils: 60 to 70 percent
Aquents and similar soils: 25 to 40 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Histosols

Surface layer:
0 to 14 inches—black muck

Subsoil:
14 to 80 inches—black friable muck

Aquents

Surface layer:
0 to 5 inches—very dark gray mucky loamy fine sand

Substratum:
5 to 8 inches—olive gray loamy fine sand
8 to 80 inches—light gray sand

Soil Properties and Qualities

Permeability: Histosols—moderately rapid to moderately slow; Aquents—moderately rapid to moderately slow in the organic material and rapid in the sandy underlying material
Available water capacity: Histosols—high; Aquents—low
Drainage class: Very poorly drained
Seasonal high water table: 2.0 feet to 0.5 foot above the surface from January to December
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: None
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils on the higher landforms

Similiar inclusions:
• Areas of Histosols and Aquents that are frequently flooded

Use and Management

Land Use: Wetland wildlife habitat (fig. 8)

Management measures and considerations:
• Onsite investigation is needed to determine the suitability of this map unit for specific uses.

Interpretive Groups

Land capability classification: Histosols—5w; Aquents—6w
Woodland ordination symbol: None assigned

87—Ausable muck, frequently flooded

Setting

Landform: Low flats and depressions along perennial rivers and creeks on flood plains
Shape of areas: Irregular or linear
Size of areas: 5 to 85 acres

Composition

Ausable soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Surface layer:
0 to 6 inches—black muck

Substratum:
6 to 11 inches—black muck
11 to 38 inches—light brownish gray sand
38 to 80 inches—grayish brown sand that has thin horizontal strata of very dark gray and black muck

Soil Properties and Qualities

Permeability: Moderate or moderately rapid
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface from September to June
Surface runoff: Negligible
Flooding: Frequent from November to May
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Winterfield soils that are somewhat poorly drained and have a sandy surface layer, on the slightly higher landforms

Similar inclusions:
• Areas where the surface layer has less than 8 inches of muck

Figure 8.—An area of Histosols and Aquents, ponded. This map unit is used mainly as wetland wildlife habitat.

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition

Management measures and considerations:

• Because of the wetness and low soil strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.

• Landing sites generally can be used only during the driest time of the year.

• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.

• Because of the wetness, severe seedling mortality, and plant competition, trees generally are not planted on this soil.

Buildings

Major management concerns: Seasonal flooding, ponding, and frost action

Management measures and considerations:

• Because of the flooding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Seasonal flooding and ponding

Management measures and considerations:
• Because of the flooding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7w
Woodland ordination symbol: 2W

99—Roscommon mucky sand

Setting

Landform: Flats, drainageways, and depressions on outwash plains and lake plains
Shape of areas: Irregular or elongated
Size of areas: 5 to 35 acres

Composition

Roscommon soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 9 inches—black mucky sand

Substratum:
9 to 80 inches—light yellowish brown, dark brown, grayish brown, and light brownish gray very friable and loose sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September to June
Surface runoff: Very low or negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres and Finch soils on the slightly higher landforms
• Excessively drained Grayling soils on the higher landforms
• Leafriver soils that have 8 to 16 inches of muck, on landforms similar to those of the Roscommon soil

Similar inclusions:
• Areas where the substratum is gravelly below a depth of 40 inches
• Areas where the surface layer is sandy

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Skidders should not be used during wet periods, when ruts form easily.
• Equipment should be used only when the soil is relatively dry or has adequate snow cover.
• Because of the wetness and severe seedling mortality rate, trees generally are not planted on this soil.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.

Buildings

Major management concerns: Ponding, cutbanks cave, and frost action
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding and rapid permeability
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Woodland ordination symbol: 6W

131E—Rubicon-Menominee sands, 18 to 35 percent slopes

Setting

Landform: Escarpments and side slopes on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 210 acres

Composition

Rubicon soil and similar soils: 40 to 70 percent
Menominee soil and similar soils: 20 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Rubicon

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 34 inches—dark brown, strong brown, and yellowish brown very friable and loose sand

Substratum:
34 to 80 inches—brownish yellow and pale brown sand

Menominee

Surface layer:
0 to 4 inches—black sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 30 inches—dark brown and strong brown very friable sand
30 to 33 inches—brown very friable loamy sand
33 to 38 inches—reddish brown firm clay loam that is surrounded by brown very friable loamy sand
38 to 43 inches—reddish brown firm clay loam
43 to 58 inches—pale brown loose sand that has lamellae of dark brown friable sandy loam

Substratum:
58 to 80 inches—brown silty clay loam

Soil Properties and Qualities

Permeability: Rubicon—rapid; Menominee—rapid in the sandy part and moderately slow in the loamy part
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Menominee—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Rubicon—low; Menominee—moderate in the loamy substratum
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Kellogg soils on toeslopes and footslopes
• Graycalm soils that have sandy lamellae in the subsoil, on landforms similar to those of the Rubicon soil

Similar inclusions:
• Areas of Rubicon soils where the subsoil has thin layers of calcareous gravel or fine sand below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Rubicon—erosion hazard, equipment limitation, and seedling mortality; Menominee—erosion hazard, equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are poorly suited to building sites without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Rubicon—7s; Menominee—7e
Woodland ordination symbol: 6R

147B—Lindquist sand, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on outwash plains, kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 175 acres

Composition

Lindquist soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 34 inches—dark brown and strong brown very friable sand
34 to 39 inches—light yellowish brown very friable sand
39 to 77 inches—light yellowish brown very friable sand that has lamellae of strong brown very friable loamy sand

Substratum:
77 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms
• Very poorly drained Roscommon soils in depressions

Similar inclusions:
• Areas where the soil is sandy throughout
• Areas where the soil is saturated below a depth of 30 inches
• Areas where the subsoil is lighter or darker in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 6S

147C—Lindquist sand, 6 to 12 percent slopes

Setting

Landform: Knolls and ridges on outwash plains, morainic remnants, kame moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Composition

Lindquist soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 34 inches—dark brown and strong brown very friable sand
34 to 39 inches—light yellowish brown very friable sand
39 to 77 inches—light yellowish brown very friable sand that has lamellae of strong brown very friable loamy sand

Substratum:
77 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• The moderately well drained Croswell soils in the lower positions on the landscape

Similar inclusions:
• Areas where the soil is sandy throughout
• Areas where the soil is saturated below a depth 60 inches
• Areas where the subsoil has thin layers of gravel below a depth of 40 inches
• Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop

residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 6S

147D—Lindquist sand, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on outwash plains, remnant moraines, kame moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Composition

Lindquist soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 34 inches—dark brown and strong brown very friable sand
34 to 39 inches—light yellowish brown very friable sand
39 to 77 inches—light yellowish brown very friable sand that has lamellae of strong brown very friable loamy sand

Substratum:
77 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Mancelona soils that have gravel at a depth of 20 to

40 inches, on landforms similar to those of the Lindquist soil

Similar inclusions:
- Areas where the soil is sandy throughout
- Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 6S

147E—Lindquist sand, 18 to 35 percent slopes

Setting

Landform: Escarpments, side slopes, and ridgetops on morainic remnants and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Composition

Lindquist soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 34 inches—dark brown and strong brown very friable sand
34 to 39 inches—light yellowish brown very friable sand
39 to 77 inches—light yellowish brown very friable sand that has lamellae of strong brown very friable loamy sand

Substratum:
77 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Mancelona soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Lindquist soil

Similar inclusions:
- Areas where the soil is sandy throughout
- Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is poorly suited to building sites without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 6S

159A—Finch sand, 0 to 3 percent slopes

Setting

Landform: Flats and swales on lake plains, outwash plains, and kame moraines
Shape of areas: Irregular or elongated
Size of areas: 5 to 120 acres

Composition

Finch soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black decomposed forest litter

Subsurface layer:
2 to 11 inches—grayish brown sand

Subsoil:
11 to 17 inches—dark reddish brown and yellowish red mottled strongly cemented sand
17 to 27 inches—light yellowish brown and dark brown mottled strongly cemented sand

Substratum:
27 to 80 inches—yellowish brown and pale brown mottled sand

Soil Properties and Qualities

Permeability: Moderately rapid in the ortstein and rapid in the rest of the profile
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 0.5 foot to 1.5 feet from October to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the higher landforms
• Very poorly drained Kinross soils in drainageways and on the lower landforms

Similar inclusions:
• Areas where the subsoil is less than 50 percent cemented
• Areas where the substratum is loamy below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland and pasture; other uses—cropland and building site development

Cropland

Major management concerns: Seasonal wetness, available water capacity, soil blowing, and nutrient and pesticide loss
Management measures and considerations:
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Droughtiness, soil blowing, and seasonal wetness
Management measures and considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• Trees that can withstand seasonal wetness should be selected for planting.
• Special harvesting methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness, and frost action
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.

Septic tank absorption fields

Major management concerns: Seasonal wetness and rapid permeability
Management measures and considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4w
Woodland ordination symbol: 4W

174A—Au Gres-Roscommon complex, 0 to 3 percent slopes

Setting

Landform: Flats, swales, and depressions on lake plains, outwash plains, remnant moraines, and kame moraines
Shape of areas: Irregular or elongated
Size of areas: 5 to 1,000 acres

Composition

Au Gres soil and similar soils: 45 to 55 percent
Roscommon soil and similar soils: 30 to 45 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 13 inches—dark reddish brown mottled very friable sand
13 to 24 inches—dark brown mottled loose sand

Substratum:
24 to 80 inches—yellowish brown, light yellowish brown, and light brownish gray mottled sand

Roscommon

Surface layer:
0 to 8 inches—black muck

Substratum:
8 to 80 inches—light yellowish brown, dark brown, brown, and pale brown very friable and loose sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Au Gres—somewhat poorly drained; Roscommon—very poorly drained
Seasonal high water table: Au Gres—at a depth of 0.5 foot to 1.5 feet from October to June; Roscommon—1 foot above to 1 foot below the surface from September to June
Surface runoff: Au Gres—negligible; Roscommon—very low or negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Au Gres—severe; Roscommon—moderate
Shrink-swell potential: Low
Potential for frost action: Au Gres—moderate; Roscommon—high

Inclusions

Contrasting inclusions:
• Leafriver and Dawson soils that have a mucky surface layer more than 8 inches thick, on landforms similar to those of the Roscommon soil

Similar inclusions:
• Areas of Au Gres soils where the subsoil is more than 50 percent cemented
• Areas of Au Gres soils where the substratum is clayey below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Au Gres—cutbanks cave, seasonal wetness, and frost action; Roscommon—cutbanks cave, seasonal wetness, frost action, and ponding
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.
• Because of the ponding, this map unit is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Au Gres—seasonal wetness and rapid permeability; Roscommon—seasonal wetness, rapid permeability, and ponding
Management measures and considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches

with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Because of the ponding, this map unit is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Au Gres—4w; Roscommon—6w
Woodland ordination symbol: 6W

197A—Gladwin loamy sand, 0 to 3 percent slopes

Setting

Landform: Flats and swales in valley trains
Shape of areas: Irregular or elongated
Size of areas: 5 to 850 acres

Composition

Gladwin soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 5 inches—black loamy sand

Subsurface layer:
5 to 13 inches—brown loamy sand

Subsoil:
13 to 17 inches—brown mottled very friable loamy sand
17 to 32 inches—brown mottled friable sandy loam and gravelly sandy loam

Substratum:
32 to 80 inches—stratified brown mottled very gravelly loamy sand and sand

Soil Properties and Qualities

Permeability: Moderately rapid in the upper part and very rapid in the lower part
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 0.5 foot to 1.5 feet from September to June
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Somewhat excessively drained Mancelona soils on the higher landforms
• Very poorly drained Roscommon soils on landforms similar to those of the Gladwin soil

Similar inclusions:
• Areas where the substratum has less than 15 pecent gravel
• Areas where the seasonal high water table is at a depth of 2.0 to 3.5 feet

Use and Management

Land Use: Dominant uses—woodland and pasture; other uses—cropland and building site development

Cropland

Major management concerns: Seasonal wetness, available water capacity, soil blowing, and nutrient and pesticide loss
Management measures and considerations:
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Droughtiness, soil blowing, and seasonal wetness
Management measures and considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of

equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting.
- Special harvesting methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness, and frost action
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.

Septic tank absorption fields

Major management concerns: Seasonal wetness and very rapid permeability in the substratum
Management measures and considerations:
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 3w
Woodland ordination symbol: 5W

338B—Islandlake sand, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on outwash plains, kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 350 acres

Composition

Islandlake soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Moderate
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Somewhat poorly drained Au Gres soils in swales
- Moderately well drained Croswell soils on the slightly lower landforms
- Southwells soils that have a loamy subsoil, on landforms similar to those of the Islandlake soil
- Very poorly drained Roscommon soils in depressions

Similar inclusions:
- Areas where the soil is sandy throughout
- Areas where the subsoil has loamy and sandy bands that accumulate to more than 6 inches in thickness
- Areas where the subsoil has thin layers of

calcareous gravel or fine sand below a depth of 40 inches
- Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Because of the limited available water capacity, most crops should be irrigated.
- The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 3S

338C—Islandlake sand, 6 to 12 percent slopes

Setting

Landform: Knolls and ridges on outwash plains, kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 350 acres

Composition

Islandlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None

Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the lower landscape
• Southwells soils have a loamy subsoil, on landforms similar to those of the Islandlake soil

Similar inclusions:
• Areas where the soil is sandy throughout
• Areas where the subsoil has loamy and sandy bands that accumulate to more than 6 inches in thickness
• Areas where the subsoil has thin layers of gravel below a depth of 40 inches
• Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, water erosion, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 3S

338D—Islandlake sand, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 5 to 350 acres

Composition

Islandlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Menominee soils that have a loamy subsoil at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake soil
- Southwells soils that have a loamy subsoil below a depth of 40 inches, on landforms similar to those of the Islandlake soil

Similar inclusions:
- Areas where the soil is sandy throughout
- Areas where the subsoil has loamy and sandy bands that accumulate to more than 6 inches in thickness
- Areas where the subsoil has thin layers of gravel below a depth of 40 inches
- Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—pasture and building site development

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 3S

338E—Islandlake sand, 18 to 35 percent slopes

Setting

Landform: Escarpments and ridgetops on remnant moraines and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Composition

Islandlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 80 inches
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Menominee soils that have a loamy substratum at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake soil
• Southwells soils that have a loamy subsoil at a depth of 40 inches, on landforms similar to those of the Islandlake soil

Similar inclusions:
• Areas where the soil is sandy throughout
• Areas where the subsoil has loamy and sandy bands that accumulate to more than 6 inches in thickness
• Areas where the subsoil has thin layers of gravel below a depth of 40 inches
• Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is poorly suited to building sites without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 3R

360—Wakeley muck

Setting

Landform: Flats, swales, and depressions on lake plains

Shape of areas: Irregular or elongated
Size of areas: 5 to 100 acres

Composition

Wakeley soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 7 inches—black muck

Substratum:
7 to 22 inches—dark grayish brown, light olive brown, and light yellowish brown mottled sand
22 to 80 inches—yellowish brown and brown very firm silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy material and very slow in the clayey underlying material
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: 1.0 foot above to 1.0 foot below the surface from September to May
Surface runoff: Low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the sandy part and high in the clayey part
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Burleigh soils that have a stratified substratum, in depressions and drainageways in similar landscape positions
• Allendale soils that are somewhat poorly drained, on the slightly higher landforms
• Springport soils that are clayey throughout, in depressions and drainageways on landforms similar to those of the Wakeley soil

Similar inclusions:
• Areas of Wakeley soils where the surface layer has 8 to 16 inches of muck
• Areas where the surface layer is sand

Use and Management

Land Use: Dominant uses—woodland; other uses—wildlife habitat

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Ponding, seasonal wetness, high shrink-swell potential in the lower part of the subsoil and in the substratum, and frost action
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, seasonal wetness, rapid permeability in the sandy part, and very slow permeability in the clayey part
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Woodland ordination symbol: 3W

366B—Islandlake-Blue Lake complex, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 725 acres

Composition

Islandlake soil and similar soils: 40 to 60 percent
Blue Lake soil and similar soils: 30 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Blue Lake—moderately rapid
Available water capacity: Low
Drainage class: Islandlake—somewhat excessively drained; Blue Lake—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Islandlake—severe; Blue Lake—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Montcalm soils that have more clay in the subsoil than the Islandlake and Blue Lake soils, on similar landforms
• Very poorly drained Roscommon soils in depressions

Similar inclusions:
• Areas of Islandlake soils where the subsoil is sandy throughout
• Areas of Islandlake and Blue Lake soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Islandlake soils where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Islandlake—seasonal droughtiness, nutrient and pesticide loss, and soil blowing; Blue Lake—seasonal droughtiness and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Blue Lake—plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring

and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Islandlake soil
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Islandlake—4s; Blue Lake—3s
Woodland ordination symbol: Islandlake—3S; Blue Lake—3A

366C—Islandlake-Blue Lake complex, 6 to 12 percent slopes

Setting

Landform: Knolls and ridges on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular or elongated
Size of areas: 20 to 420 acres

Composition

Islandlake soil and similar soils: 40 to 60 percent
Blue Lake soil and similar soils: 30 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Blue Lake—moderately rapid
Available water capacity: Low
Drainage class: Islandlake—somewhat excessively drained; Blue Lake—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Islandlake—severe; Blue Lake—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the lower landforms
• Southwells soils that have a loamy subsoil, on landforms similar to those of the Islandlake and Blue Lake soils

Similar inclusions:
• Areas of Islandlake soils where the subsoil is sandy throughout
• Areas of Islandlake and Blue Lake soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Islandlake and Blue Lake soils where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Islandlake—water erosion, seasonal droughtiness, nutrient and pesticide loss, and soil blowing; Blue Lake—water erosion, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Crop residue management and a cropping sequence that includes close-growing crops help to control water erosion.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Blue Lake—plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Islandlake—rapid permeability and slope; Blue Lake—slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distrubution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Islandlake—6s; Blue Lake—3s
Woodland ordination symbol: Islandlake—3S; Blue Lake—3A

366D—Islandlake-Blue Lake complex, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines, remnant moraines, and outwash plains
Shape of areas: Irregular or elongated
Size of areas: 20 to 210 acres

Composition

Islandlake soil and similar soils: 45 to 60 percent
Blue Lake soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand

6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Blue Lake—moderately rapid
Available water capacity: Low
Drainage class: Islandlake—somewhat excessively drained; Blue Lake—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Islandlake—severe; Blue Lake—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Southwells soils that have a loamy subsoil, on landforms similar to those of the Islandlake and Blue Lake soils

Similar inclusions:
• Areas of Islandlake soils where the subsoil is sandy throughout
• Areas of Islandlake and Blue Lake soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Islandlake and Blue Lake soils where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Islandlake—water erosion, seasonal droughtiness, nutrient and pesticide loss, and soil blowing; Blue Lake—water erosion, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Crop residue management and a cropping sequence that includes close-growing crops help to control water erosion.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Blue Lake—plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation is needed to

control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Islandlake—rapid permeability and slope; Blue Lake—slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distrubution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Islandlake—6s; Blue Lake—3s
Woodland ordination symbol: Islandlake—3S; Blue Lake—3A

366E—Islandlake-Blue Lake complex, 18 to 35 percent slopes

Setting

Landform: Escarpments, side slopes, and ridgetops on kame moraines and remnant moraines
Shape of areas: Irregular or elongated
Size of areas: 20 to 185 acres

Composition

Islandlake soil and similar soils: 45 to 60 percent
Blue Lake soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Blue Lake—moderately rapid
Available water capacity: Low
Drainage class: Islandlake—somewhat excessively drained; Blue Lake—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Islandlake—severe; Blue Lake—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Southwells soils that have a loamy subsoil, on landforms similar to those of the Islandlake and Blue Lake soils

Similar inclusions:
• Areas of Islandlake soils where the subsoil is sandy throughout
• Areas of Islandlake and Blue Lake soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Islandlake and Blue Lake soils where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Islandlake—erosion hazard, equipment limitation, and seedling mortality; Blue Lake—erosion hazard, equipment limitation, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are poorly suited to building sites without extensive land shaping.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Islandlake—slope and rapid permeability; Blue Lake—slope
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Islandlake—7s; Blue Lake—3s
Woodland ordination symbol: Islandlake—3R; Blue Lake—3A

371—Springport silt loam

Setting

Landform: Flats and depressions on lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 3 to 35 acres

Composition

Springport soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 8 inches—black silt loam

Subsoil:
8 to 13 inches—gray mottled firm silty clay
13 to 80 inches—gray and olive brown mottled firm silty clay

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September to June
Surface runoff: High
Flooding: None
Hazard of water erosion Slight
Hazard of soil blowing: Slight
Shrink-swell potential: High
Potential for frost action: High

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Allendale and Algonquin soils on the slightly higher landforms
• Moderately well drained Negwegon soils on knolls

Similar inclusions:
• Areas where the subsoil has less clay
• Areas where the substratum is sandy below a depth of 60 inches

Use and Management

Land Use: Dominant uses—woodland; other uses—pasture

Pasture

Major management concerns: Compaction, seasonal wetness, and ponding
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

Woodland

Major management concerns: Equipment limitation, seedling mortatity, windthrow hazard, and plant competition
Management measures and considerations:
• Skidders should not be used during wet periods, when ruts form easily.
• Equipment should be used only when the soil is relatively dry or has adequate snow cover.
• Because of the wetness and severe seedling mortality, trees generally are not planted on this soil.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Ponding, high shrink-swell potential, and frost action
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding and very slow permeability
Management measures and considerations:
• Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Woodland ordination symbol: 6W

380—Access denied

Setting

Shape of areas: Square or rectangular
Size of areas: 40 to 150 acres

Composition

Composition is unknown.

Use and Management

Because access was denied, no interpretations are given for these areas. Onsite investigation is needed.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned

402B—Islandlake loamy sand, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 5 to 350 acres

Composition

Islandlake soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loamy sand

Subsoil:
9 to 18 inches—dark reddish brown and dark brown very friable loamy sand
18 to 39 inches—dark brown very friable sand
39 to 45 inches—dark yellowish brown loose sand
45 to 80 inches—light yellowish brown loose sand that has lamellae of dark brown very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight

Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Somewhat poorly drained Au Gres soils in swales
- Moderately well drained Halfaday soils on the slightly lower landforms
- Morganlake soils that have a loamy substratum at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake soil
- Southwells soils that have a loamy subsoil at a depth of 40 to 60 inches, on landforms similar to those of the Islandlake soil
- Very poorly drained Roscommon soils in depressions

Similar inclusions:
- Areas where the soil is sandy throughout
- Areas where the subsoil has loamy and sandy bands that accumulate to more than 6 inches in thickness
- Areas where the subsoil has a water table at a depth of 60 to 80 inches
- Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Because of the limited available water capacity, most crops should be irrigated (fig. 9).
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Woodland ordination symbol: 3A

402C—Islandlake loamy sand, 6 to 12 percent slopes

Setting

Landform: Knolls and side slopes on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 5 to 85 acres

Composition

Islandlake soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loamy sand

Subsoil:
9 to 18 inches—dark reddish brown and dark brown very friable loamy sand
18 to 39 inches—dark brown very friable sand
39 to 45 inches—dark yellowish brown loose sand
45 to 80 inches—light yellowish brown loose sand that has lamellae of dark brown very friable loamy sand

Figure 9.—An area of Islandlake loamy sand, 0 to 6 percent slopes. Many areas of Islandlake soils are irrigated and used in the production of potatoes and beans.

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Somewhat poorly drained Au Gres soils in swales
- Moderately well drained Halfaday soils on the slightly lower landforms
- Southwells soils that have a loamy subsoil, on landforms similar to those of the Islandlake soil

Similar inclusions:
- Areas where the soil is sandy throughout
- Areas where the subsoil has loamy and sandy bands that accumulate to more than 6 inches in thickness
- Areas where the subsoil has thin layers of calcareous gravel below a depth of 40 inches
- Areas where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
• Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Woodland ordination symbol: 3S

406A—Winterfield loamy sand, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flats on stream terraces
Shape of areas: Irregular or elongated
Size of areas: 5 to 80 acres

Composition

Winterfield soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Surface layer:
0 to 7 inches—very dark grayish brown loamy sand

Subsoil:
7 to 18 inches—yellowish brown and pale brown mottled very friable sand
18 to 21 inches—brown mottled very friable gravelly loamy sand

Substratum:
21 to 80 inches—light brownish gray mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 0.5 foot to 3.0 feet from September to July
Surface runoff: Very low
Flooding: Rare from March to April
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Very poorly drained Ausable soils that have a mucky surface layer, on low landforms

Similar inclusions:
• Areas where the seasonal high water table is at a depth of 2.0 to 3.5 feet

Use and Management

Land Use: Dominant uses—woodland; other uses—recreation

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• Trees that can withstand seasonal wetness should be selected for planting.
• Special harvesting methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Seasonal flooding
Management measures and considerations:
• Because of the flooding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Seasonal flooding
Management measures and considerations:
• Because of the flooding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 4w
Woodland ordination symbol: 6W

412A—Ingalls-Burleigh loamy sands, 0 to 3 percent slopes

Setting

Landform: Broad plains and depressions and low knolls on lake plains
Shape of areas: Irregular
Size of areas: 10 to 600 acres

Composition

Ingalls soil and similar soils: 45 to 65 percent
Burleigh soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Ingalls

Surface layer:
0 to 7 inches—very dark gray loamy sand

Subsurface layer:
7 to 8 inches—grayish brown loamy sand

Subsoil:
8 to 13 inches—dark reddish brown mottled very friable loamy sand
13 to 26 inches—dark brown and yellowish brown very friable sand

Substratum:
26 to 80 inches—stratified brown and reddish brown mottled loamy sand and silty clay loam

Burleigh

Surface layer:
0 to 9 inches—black loamy sand

Substratum:
9 to 21 inches—light brownish gray mottled loamy sand
21 to 42 inches—stratified brown and gray mottled sandy loam, silt loam, and silty clay loam
42 to 80 inches—stratified grayish brown mottled loamy sand, silty clay loam, and sandy loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and moderately slow in the loamy underlying material
Available water capacity: Moderate
Drainage class: Ingalls—somewhat poorly drained; Burleigh—poorly drained
Seasonal high water table: Ingalls—at a depth of 0.5 foot to 1.5 feet from September to June; Burleigh—1 foot above to 1 foot below the surface from September to June
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
- Algonquin soils that are clayey throughout, on landforms similar to those of the Ingalls soil
- Very poorly drained Wakeley soils in landscape positions similar to those of the Burleigh soil
- Well drained Southwells soils on the higher landforms

Similar inclusions:
- Areas of Ingalls soils where the sandy subsoil is less than 20 inches thick
- Areas of Burleigh soils where the surface layer is muck

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Seasonal wetness, permeability, soil blowing, and nutrient and pesticide loss
Management measures and considerations:
- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Subsurface drainage systems should be designed so that the rate of flowing water helps to keep fine sand and silt from plugging the tile lines. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, and overgrazing
Management measures and considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Special site preparation, such as bedding prior to planting, can reduce the seedling mortality rate.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Ingalls—seasonal wetness, cutbanks cave, and frost action; Burleigh—seasonal wetness, cutbanks cave, frost action, and ponding
Management measures and considerations:
- A surface or subsurface drainage system helps to lower the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Properly designing and strengthening footings and foundations can help to prevent structural damage caused by frost action.
- Because of the ponding, the Burleigh soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ingalls—seasonal wetness, rapid permeability in the upper part, and moderately slow permeability in the lower part; Burleigh—seasonal wetness, rapid permeability in the upper part, moderately slow permeability in the lower part, and ponding
Management measures and considerations:
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• Because of the ponding, the Burleigh soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Ingalls—3w; Burleigh—5w
Woodland ordination symbol: Ingalls—4W; Burleigh—2W

454B—Springlake sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, stream terraces, and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 1,200 acres

Composition

Springlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 7 inches—dark reddish brown very friable sand
7 to 37 inches—dark brown and strong brown loose sand
37 to 40 inches—strong brown very friable gravelly loamy sand

Substratum:
40 to 80 inches—light yellowish brown stratified sand and gravelly sand

Soil Properties and Qualities

Permeability: Very rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the surface layer has more clay
• Areas where the substratum has less than 15 percent gravel
• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Very rapid permeability
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Woodland ordination symbol: 3S

454C—Springlake sand, 6 to 12 percent slopes

Setting

Landform: Knolls and low ridges on outwash plains, stream terraces, and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 120 acres

Composition

Springlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 7 inches—dark reddish brown very friable sand
7 to 37 inches—dark brown and strong brown loose sand
37 to 40 inches—strong brown very friable gravelly loamy sand

Substratum:
40 to 80 inches—light yellowish brown stratified sand and gravelly sand

Soil Properties and Qualities

Permeability: Very rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Au Gres soils in swales
• Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
• Areas where the substratum has less than 15 percent gravel
• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.

- Because of the limited available water capacity, most crops should be irrigated.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Very rapid permeability and slope
Management measures and considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 3S

454D—Springlake sand, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on stream terraces and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 90 acres

Composition

Springlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 7 inches—dark reddish brown very friable sand
7 to 37 inches—dark brown and strong brown loose sand
37 to 40 inches—strong brown very friable gravelly loamy sand

Substratum:
40 to 80 inches—light yellowish brown stratified sand and gravelly sand

Soil Properties and Qualities

Permeability: Very rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Moderately well drained Croswell soils on the slightly lower landforms

Similar inclusions:
- Areas where the substratum has less than 15 percent gravel
- Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Very rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 3S

454E—Springlake sand, 18 to 35 percent slopes

Setting

Landform: Ridgetops and escarpments on stream terraces and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Composition

Springlake soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 7 inches—dark reddish brown very friable sand
7 to 37 inches—dark brown and strong brown loose sand
37 to 40 inches—strong brown very friable gravelly loamy sand

Substratum:
40 to 80 inches—light yellowish brown stratified sand and gravelly sand

Soil Properties and Qualities

Permeability: Very rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet

Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Well drained Mancelona soils that have more clay in the subsoil than the Springlake soil, on similar landforms

Similar inclusions:
• Areas where the substratum has less than 15 percent gravel
• Areas where the upper part of the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, this soil is poorly suited to building sites without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope and very rapid permeability
Management measures and considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 3S

457B—Islandlake-Southwells complex, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 975 acres

Composition

Islandlake soil and similar soils: 45 to 55 percent
Southwells soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Southwells

Surface layer:
0 to 1 inch—black loamy sand

Subsurface layer:
1 to 3 inches—brown loamy sand

Subsoil:
3 to 13 inches—dark yellowish brown very friable loamy sand
13 to 25 inches—dark brown very friable sand
25 to 57 inches—pale brown loose sand that is surrounded by dark yellowish brown friable loamy sand
57 to 66 inches—dark yellowish brown friable sandy loam that is surrounded by very pale brown very friable loamy sand

Substratum:
66 to 73 inches—yellowish brown sandy loam
73 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Southwells—moderately rapid
Available water capacity: Islandlake—low; Southwells—moderate
Drainage class: Islandlake—somewhat excessively drained; Southwells—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Islandlake—severe; Southwells—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Mancelona soils the have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake and Southwells soils

Similar inclusions:
• Areas of Southwells soils where the subsoil has more clay
• Areas of Islandlake soils where the subsoil is sandy throughout

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Southwells—equipment limitation and plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Islandlake—rapid permeability; Southwells—moderately rapid permeability
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.

• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Islandlake—4s; Southwells—3e
Woodland ordination symbol: Islandlake—3S; Southwells—3A

457C—Islandlake-Southwells complex, 6 to 12 percent slopes

Setting

Landform: Knolls and ridges on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 700 acres

Composition

Islandlake soil and similar soils: 45 to 55 percent
Southwells soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Southwells

Surface layer:
0 to 1 inch—black loamy sand

Subsurface layer:
1 to 3 inches—brown loamy sand

Subsoil:
3 to 13 inches—dark yellowish brown very friable loamy sand
13 to 25 inches—dark brown very friable sand
25 to 57 inches—pale brown loose sand that is surrounded by dark yellowish brown friable loamy sand
57 to 66 inches—dark yellowish brown friable sandy loam that is surrounded by very pale brown very friable loamy sand

Substratum:
66 to 73 inches—yellowish brown sandy loam
73 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Southwells—moderately rapid
Available water capacity: Islandlake—low; Southwells—moderate
Drainage class: Islandlake—somewhat excessively drained; Southwells—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Islandlake—severe; Southwells—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Mancelona soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake and Southwells soils

Similar inclusions:
• Areas of Southwells soils where the subsoil has more clay
• Areas of Islandlake soils where the subsoil is sandy throughout

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Islandlake—soil blowing, seasonal droughtiness, and nutrient and pesticide loss; Southwells—soil blowing, seasonal droughtiness, nutrient and pesticide loss, and water erosion
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover

crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Southwells—equipment limitation and plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting in early spring and late fall when the soil is moist and using careful planting procedures can reduce the seedling mortality rate.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Islandlake—rapid permeability and slope; Southwells—moderately rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Islandlake—6s; Southwells—3e
Woodland ordination symbol: Islandlake—3S; Southwells—3A

457D—Islandlake-Southwells complex, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 325 acres

Composition

Islandlake soil and similar soils: 45 to 55 percent
Southwells soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Southwells

Surface layer:
0 to 1 inch—black loamy sand

Subsurface layer:
1 to 3 inches—brown loamy sand

Subsoil:
3 to 13 inches—dark yellowish brown very friable loamy sand
13 to 25 inches—dark brown very friable sand
25 to 57 inches—pale brown loose sand that is surrounded by dark yellowish brown friable loamy sand
57 to 66 inches—dark yellowish brown friable sandy loam that is surrounded by very pale brown very friable loamy sand

Substratum:
66 to 73 inches—yellowish brown sandy loam
73 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Southwells—moderately rapid
Available water capacity: Islandlake—low; Southwells—moderate
Drainage class: Islandlake—somewhat excessively drained; Southwells—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Islandlake—severe; Southwells—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Mancelona soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake and Southwells soils

Similar inclusions:
• Areas of Southwells soils that have more clay in the subsoil
• Areas of Islandlake soils where the subsoil is sandy throughout

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Islandlake—soil blowing, seasonal droughtiness, and nutrient and pesticide loss; Southwells—soil blowing, seasonal droughtiness, nutrient and pesticide loss, and water erosion
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Southwells—equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform

to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Islandlake—rapid permeability and slope; Southwells—moderately rapid permeability and slope

Management measures and considerations:

- The poor filtering capacity of the soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Islandlake—7s; Southwells—4e

Woodland ordination symbol: Islandlake—3S; Southwells—3A

457E—Islandlake-Southwells complex, 18 to 35 percent slopes

Setting

Landform: Ridgetops and escarpments on kame moraines and remnant moraines

Shape of areas: Irregular

Size of areas: 10 to 125 acres

Composition

Islandlake soil and similar soils: 50 to 60 percent
Southwells soil and similar soils: 30 to 45 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Southwells

Surface layer:
0 to 1 inch—black loamy sand

Subsurface layer:
1 to 3 inches—brown loamy sand

Subsoil:
3 to 13 inches—dark yellowish brown very friable loamy sand
13 to 25 inches—dark brown very friable sand
25 to 57 inches—pale brown loose sand that is surrounded by dark yellowish brown friable loamy sand
57 to 66 inches—dark yellowish brown friable sandy loam that is surrounded by very pale brown very friable loamy sand

Substratum:
66 to 73 inches—yellowish brown sandy loam
73 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Islandlake—rapid; Southwells—moderately rapid

Available water capacity: Islandlake—low; Southwells—moderate

Drainage class: Islandlake—somewhat excessively drained; Southwells—well drained

Seasonal high water table: At a depth of more than 6 feet

Surface runoff: Low

Flooding: None

Hazard of water erosion: Severe

Hazard of soil blowing: Islandlake—severe; Southwells—moderate

Shrink-swell potential: Low

Potential for frost action: Low

Inclusions

Contrasting inclusions:

- Mancelona soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Islandlake and Southwells soils

Similar inclusions:

- Areas of Southwells soils where the subsoil has more clay
- Areas of Islandlake soils where the subsoil is sandy throughout

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Islandlake—erosion hazard, equipment limitation, and seedling mortality; Southwells—erosion hazard, equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Islandlake—slope and rapid permeability; Southwells—slope and moderately rapid permeability
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Islandlake—7s; Southwells—7e
Woodland ordination symbol: 3R

458D—Islandlake-Menominee sands, 12 to 18 percent slopes

Setting

Landform: Knolls, low ridges, and side slopes on kame moraines and remnant moraines
Shape of areas: Irregular
Size of areas: 10 to 156 acres

Composition

Islandlake soil and similar soils: 50 to 70 percent
Menominee soil and similar soils: 20 to 45 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Islandlake

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 6 inches—reddish brown very friable loamy sand
6 to 27 inches—dark brown and strong brown very friable sand
27 to 52 inches—yellowish brown very friable sand
52 to 80 inches—light yellowish brown very friable sand that has lamellae of dark brown very friable loamy sand

Menominee

Surface layer:
0 to 4 inches—black sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 30 inches—dark brown and strong brown very friable sand
30 to 33 inches—brown very friable loamy sand
33 to 38 inches—reddish brown firm clay loam that is surrounded by brown very friable loamy sand
38 to 43 inches—reddish brown firm clay loam
43 to 58 inches—pale brown loose sand that has lamellae of dark brown friable sandy loam

Substratum:
58 to 80 inches—brown silty clay loam

Soil Properties and Qualities

Permeability: Islandlake—rapid; Menominee—rapid in the sandy part and moderately slow in the loamy underlying material

Available water capacity: Islandlake—low; Menominee—moderate
Drainage class: Islandlake—somewhat excessively drained; Menominee—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Islandlake—low; Menominee—low in the sandy part and moderate in the loamy part
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Southwells soils that have a loamy subsoil at a depth of 40 to 60 inches, on landforms similar to those of the Islandlake soil

Similar inclusions:
• Areas of Islandlake soils where the subsoil has thin layers of calcareous gravel or fine sand below a depth of 60 inches
• Areas of Islandlake soils where the subsoil has more than 6 inches of lamellae

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Islandlake—equipment limitation and seedling mortality; Menominee—equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Islandlake—slope and rapid permeability; Menominee—slope, rapid permeability in the sandy part, and moderately slow permeability in the loamy part
Management measures and considerations:
• Land shaping and installing the distribution lines on the contour help to overcome the slope.
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: Islandlake—7s; Menominee—4e
Woodland ordination symbol: Islandlake—3S; Menominee—6S

459B—Rubicon sand, calcareous substratum, 0 to 6 percent slopes

Setting

Landform: Knolls and flats on stream terraces, remnant moraines, and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Composition

Rubicon soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Au Gres soils that are somewhat poorly drained, on the lower landforms
- East Lake soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Rubicon soil

Similar inclusions:
- Areas where the soil has bands of loamy sand in the subsoil
- Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 5S

459D—Rubicon sand, calcareous substratum, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on stream terraces, remnant moraines, and kame moraines
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Composition

Rubicon soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe

Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Blue Lake soils that have more clay in the subsoil than the Rubicon soil, on similar landforms
• East Lake soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Rubicon soil

Similar inclusions:
• Areas where the soil has bands of loamy sand in the subsoil
• Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation and seedling mortality
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Woodland ordination symbol: 5S

459E—Rubicon sand, calcareous substratum, 18 to 35 percent slopes

Setting

Landform: Ridgetops and escarpments on kame moraines, remnant moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 65 acres

Composition

Rubicon soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Blue Lake soils that have more clay in the subsoil than the Rubicon soil, on similar landforms
• East Lake soils that have gravel at a depth of 20 to 40 inches, on landforms similar to those of the Rubicon soil

Similar inclusions:
- Areas where the soil has bands of loamy sand in the subsoil
- Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, and seedling mortality
Management measures and considerations:
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade of roads and landings should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
- Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Woodland ordination symbol: 5R

460B—Rubicon, calcareous substratum-Mancelona sands, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines, stream terraces, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 225 acres

Composition

Rubicon soil and similar soils: 40 to 60 percent
Mancelona soil and similar soils: 30 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Rubicon

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Soil Properties and Qualities

Permeability: Rubicon—rapid; Mancelona—moderately rapid in the sandy material and very rapid in the gravelly underlying material
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Mancelona—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Somewhat poorly drained Au Gres soils in swales
- Moderately well drained Croswell soils on the slightly lower landforms
- Southwells soils that have a loamy subsoil and a sandy substratum, on landforms similar to those of the Rubicon and Mancelona soils
- Very poorly drained Roscommon soils in depressions

Similar inclusions:
- Areas where the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Because of the limited available water capacity, most crops should be irrigated.
- The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Rubicon—equipment limitation and seedling mortality; Mancelona—equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability
Management measures and considerations:
- The poor filtering capacity of the soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: Rubicon—6s; Mancelona—3s
Woodland ordination symbol: Rubicon—5S; Mancelona—3S

460C—Rubicon, calcareous substratum-Mancelona sands, 6 to 12 percent slopes

Setting

Landform: Knolls and low ridges on kame moraines, stream terraces, and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 225 acres

Composition

Rubicon soil and similar soils: 40 to 60 percent
Mancelona soil and similar soils: 30 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Rubicon

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Soil Properties and Qualities

Permeability: Rubicon—rapid; Mancelona—moderately rapid in the sandy part and very rapid in the gravelly underlying material
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Mancelona—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Moderately well drained Croswell soils on the slightly lower landforms
• Southwells soils that have a loamy subsoil and a sandy substratum, on landforms similar to those of the Rubicon and Mancelona soils

Similar inclusions:
• Areas where the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, water erosion, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Because of the limited available water capacity, most crops should be irrigated.
• The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Rubicon—equipment limitation and seedling mortality; Mancelona—equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Rubicon—6s; Mancelona—3e
Woodland ordination symbol: Rubicon—5S; Mancelona—3S

460D—Rubicon, calcareous substratum-Mancelona sands, 12 to 18 percent slopes

Setting

Landform: Knolls, side slopes, and ridges on kame moraines and stream terraces
Shape of areas: Irregular
Size of areas: 10 to 225 acres

Composition

Rubicon soil and similar soils: 40 to 60 percent
Mancelona soil and similar soils: 30 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Rubicon

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Soil Properties and Qualities

Permeability: Rubicon—rapid; Mancelona—moderately rapid in the sandy part and very rapid in the gravelly underlying material
Available water capacity: Low

Drainage class: Rubicon—excessively drained; Mancelona—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Moderately well drained Croswell soils on the slightly lower landforms
- Southwells soils that have a loamy subsoil and a sandy substratum, on landforms similar to those of the Rubicon and Mancelona soils

Similar inclusions:
- Areas where the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development (fig. 10)

Woodland

Major management concerns: Rubicon—equipment limitation and seedling mortality; Mancelona—equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and slope
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability and slope
Management measures and considerations:
- The poor filtering capacity of the soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Rubicon—7s; Mancelona—4e
Woodland ordination symbol: Rubicon—5S; Mancelona—3S

460E—Rubicon, calcareous substratum-Mancelona sands, 18 to 35 percent slopes

Setting

Landform: Ridgetops and escarpments on kame moraines
Shape of areas: Irregular
Size of areas: 10 to 225 acres

Composition

Rubicon soil and similar soils: 45 to 65 percent
Mancelona soil and similar soils: 30 to 55 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Rubicon

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Figure 10.—A gravel pit in an area of Rubicon, calcareous substratum-Mancelona sands, 12 to 18 percent slopes.

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Soil Properties and Qualities

Permeability: Rubicon—rapid; Mancelona—moderately rapid in the sandy part and very rapid in the gravelly underlying material
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Mancelona—somewhat excessively drained

Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Southwells soils that have a loamy subsoil and a sandy substratum, on landforms similar to those of the Rubicon and Mancelona soils

Similar inclusions:
• Areas where the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Rubicon—erosion hazard, equipment limitation, and seedling mortality; Mancelona—erosion hazard, equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are poorly suited to building sites without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Rubicon—7s; Mancelona—7e
Woodland ordination symbol: Rubicon—5R; Mancelona—3R

460F—Rubicon, calcareous substratum-Mancelona sands, 35 to 55 percent slopes

Setting

Landform: Ridgetops and escarpments on kame moraines
Shape of areas: Irregular
Size of areas: 10 to 125 acres

Composition

Rubicon soil and similar soils: 45 to 65 percent
Mancelona soil and similar soils: 30 to 55 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Rubicon

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 6 inches—dark grayish brown sand

Subsoil:
6 to 38 inches—dark brown and strong brown very friable and loose sand

Substratum:
38 to 67 inches—yellowish brown and light yellowish brown sand
67 to 69 inches—dark yellowish brown loamy sand
69 to 80 inches—pale brown sand

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Soil Properties and Qualities

Permeability: Rubicon—rapid; Mancelona—moderately rapid in the sandy part and very rapid in the gravelly underlying material
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Mancelona—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Low
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Southwells soils that have a loamy subsoil and a sandy substratum, on landforms similar to those of the Rubicon and Mancelona soils

Similar inclusions:
• Areas where the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Rubicon—erosion hazard, equipment limitation, and seedling mortality; Mancelona—erosion hazard, equipment limitation, seedling mortality, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade of roads and landings should be kept as low as possible.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
• Areas with southern exposure may have higher seedling mortality rates.

Buildings

Major management concerns: Slope and cutbanks cave
Management measures and considerations:
• Because of the slope, these soils are poorly suited to building sites without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope and rapid permeability
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Rubicon—7s; Mancelona—7e
Woodland ordination symbol: Rubicon—5R; Mancelona—3R

461A—Allendale-Springport complex, 0 to 3 percent slopes

Setting

Landform: Flats, swales, and depressions on lake plains
Shape of areas: Irregular or elongated
Size of areas: 5 to 140 acres

Composition

Allendale soil and similar soils: 45 to 55 percent
Springport soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Allendale

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 10 inches—brown sand

Subsoil:
10 to 22 inches—dark brown mottled very friable sand
22 to 80 inches—brown mottled very firm silty clay

Springport

Surface layer:
0 to 8 inches—black silt loam

Subsoil:
8 to 13 inches—gray mottled firm silty clay
13 to 80 inches—gray and olive brown mottled firm silty clay

Soil Properties and Qualities

Permeability: Allendale—rapid in the sandy part and very slow in the clayey underlying material; Springport—very slow
Available water capacity: Allendale—moderate; Springport—high
Drainage class: Allendale—somewhat poorly drained; Springport—poorly drained
Seasonal high water table: Allendale—at a depth of 0.5 foot to 1.5 feet from September to June; Springport—1 foot above to 1 foot below the surface from September to June
Surface runoff: Allendale—very low; Springport—high
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Allendale—severe; Springport—slight
Shrink-swell potential: Allendale—low in the sandy upper material and high in the clayey material; Springport—high
Potential for frost action: Allendale—moderate; Springport—high

Inclusions

Contrasting inclusions:
• Burleigh soils that have a stratified substratum, in depressions and drainageways in landscape positions similar to those of the Springport soil
• Ingalls soils that are somewhat poorly drained and stratified in the substratum, on landforms similar to those of the Allendale soil
• Moderately well drained Kellogg soils on the higher landforms
• Wakeley soils that are sandy in the upper part of the subsoil, on landforms similar to those of the Springport soil

Similar inclusions:
• Areas of Allendale soils where the subsoil is more than 50 percent cemented
• Areas of Allendale soils where the surface layer has 8 to 16 inches of muck

Use and Management

Land Use: Dominant uses—woodland; other uses—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Allendale—cutbanks cave, seasonal wetness, high shrink-swell potential, and frost action; Springport—high shrink-swell potential, frost action, and ponding
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.

Septic tank absorption fields

Major management concerns: Allendale—seasonal wetness, rapid permeability in the sandy part, and very slow permeability in the clayey part;

Springport—very slow permeability in the clayey part and ponding

Management measures and considerations:

• Mounding or adding suitable fill material helps to raise the absorption field above the water table.

• The poor filtering capacity of the soils can result in the pollution of ground water.

• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

• Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: Allendale—3w; Springport—5w

Woodland ordination symbol: Allendale—4W; Springport—6W

462A—Allendale-Algonquin complex, 0 to 3 percent slopes

Setting

Landform: Swales and toeslopes on broad plains, on lake plains, and in lake basins

Shape of areas: Irregular

Size of areas: 10 to 125 acres

Composition

Allendale soil and similar soils: 40 to 55 percent

Algonquin soil and similar soils: 35 to 55 percent

Contrasting inclusions: 5 to 10 percent

Typical Profile

Allendale

Surface layer:

0 to 2 inches—black sand

Subsurface layer:

2 to 10 inches—brown sand

Subsoil:

10 to 22 inches—dark brown mottled very friable sand

22 to 80 inches—brown mottled very firm silty clay

Algonquin

Surface layer:

0 to 9 inches—very dark gray silt loam

Subsoil:

9 to 36 inches—dark yellowish brown and reddish brown mottled firm silty clay

36 to 80 inches—reddish brown mottled firm clay

Soil Properties and Qualities

Permeability: Allendale—rapid in the sandy material and very slow in the clayey underlying material; Algonquin—very slow

Available water capacity: Allendale—moderate; Algonquin—high

Drainage class: Somewhat poorly drained

Seasonal high water table: Allendale—at a depth of 0.5 foot to 1.5 feet from September to June; Algonquin—at a depth of 0.5 foot to 1.5 feet from October to May

Surface runoff: Allendale—very low; Algonquin—high

Flooding: None

Hazard of water erosion: Allendale—slight; Algonquin—moderate

Hazard of soil blowing: Allendale—severe; Algonquin—slight

Shrink-swell potential: Allendale—low in the sandy upper material and high in the lower clayey material; Algonquin—high

Potential for frost action: Allendale—moderate; Algonquin—high

Inclusions

Contrasting inclusions:

• Poorly drained Springport soils in depressions and drainageways

• Moderately well drained Kellogg soils in the slightly higher landcape positions

Similar inclusions:

• Areas of Algonquin soils where the subsoil has less clay

• Areas of Algonquin soils where the substratum is sandy at a depth of more than 60 inches

• Areas of Algonquin soils where the lower part of the subsoil and the substratum have less clay

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Allendale—seasonal wetness, water erosion, soil blowing, and seasonal droughtiness; Algonquin—seasonal wetness, very slow permeability, soil compaction, and tilth of the surface layer

Management measures and considerations:

• Both surface and subsurface drainage systems are needed to reduce the wetness.

• A system of conservation tillage that leaves crop residue on the surface helps to control water erosion

and prevent crusting during periods of heavy rainfall and increases the rate of water infiltration.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.

Pasture

Major management concerns: Allendale—seasonal wetness, overgrazing, and seasonal droughtiness; Algonquin—compaction, seasonal wetness, and overgrazing
Management measures and considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Skidders should not be used during wet periods, when ruts form easily.
• Access is easiest during periods in winter when access roads are frozen.
• Trees that can withstand seasonal wetness should be selected for planting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Allendale—seasonal wetness, high shrink-swell potential in the lower sandy material and substratum, cutbanks cave, and frost action; Algonquin—seasonal wetness, high shrink-swell potential, and frost action
Management measures and considerations:
• A surface or subsurface drainage system helps to lower the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
• Caving of cutbanks is a concern for shallow excavations in areas of the Allendale soil. Trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Allendale—seasonal wetness, very slow permeability in the clayey material, and rapid permeability in the sandy material; Algonquin—seasonal wetness and very slow permeability
Management measures and considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 3w
Woodland ordination symbol: Allendale—4W; Algonquin—6W

466B—Halfaday loamy sand, 0 to 4 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, lake plains, kame moraines, and stream terraces
Shape of areas: Irregular or elongated
Size of areas: 5 to 150 acres

Composition

Halfaday soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 1 inch—very dark gray loamy sand

Subsurface layer:
1 to 4 inches—grayish brown loamy sand

Subsoil:
4 to 11 inches—dark reddish brown and dark brown friable and very friable loamy sand

11 to 35 inches—strong brown and yellowish brown very friable and loose sand

Substratum:
35 to 80 inches—light yellowish brown and pale brown mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet from October to December and from March to May
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Excessively drained Kalkaska and somewhat excessively drained Islandlake soils on similar or slightly higher landforms

Similar inclusions:
- Areas where the surface layer is sand
- Areas where the seasonal high water table is at a depth of 6 to 18 inches
- Areas where the seasonal high water table is at a depth of 4 to 5 feet
- Areas where the upper part of the subsoil is darker

Use and Management

Land Use: Dominant uses—woodland and cropland; other uses—pasture and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
- Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Because of the limited available water capacity, most crops should be irrigated.
- The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitatiom, seedling mortality, and plant competition
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and seasonal wetness
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness and rapid permeability
Management measures and considerations:
- Filling or mounding with suitable fill material helps to raise the absorption field above the water table.
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Woodland ordination symbol: 3S

467B—Morganlake, sandy substratum-Woodman-Blue Lake complex, 1 to 6 percent slopes

Setting

Landform: Flats and low knolls on kame moraines
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Composition

Morganlake soil and similar soils: 30 to 50 percent
Woodman soil and similar soils: 20 to 35 percent
Blue Lake soil and similar soils: 20 to 30 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Morganlake

Surface layer:
0 to 6 inches—very dark grayish brown loamy sand

Subsurface layer:
6 to 7 inches—brown loamy sand

Subsoil:
7 to 22 inches—brown and strong brown very friable loamy sand and sand
22 to 35 inches—light brownish gray loamy fine sand surrounding brown friable sandy loam
35 to 49 inches—brown mottled firm fine sandy loam and clay loam

Substratum:
49 to 66 inches—brown sandy clay loam and loam
66 to 80 inches—stratified pale brown and brown sand and sandy loam

Woodman

Surface layer:
0 to 9 inches—very dark grayish brown sandy loam

Subsoil:
9 to 20 inches—pale brown sandy loam surrounding brown firm sandy clay loam
20 to 37 inches—brown mottled firm sandy clay loam
37 to 45 inches—brown firm sandy loam

Substratum:
45 to 56 inches—light brown sandy loam
56 to 80 inches—light yellowish brown sand that has lamellae of brown loamy sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Morganlake—rapid in the sandy material and moderately slow in the loamy material; Woodman—moderately slow in the loamy material and rapid in the underlying sandy material; Blue Lake—moderately rapid
Available water capacity: Morganlake and Blue Lake—low; Woodman—moderate
Drainage class: Morganlake and Woodman—moderately well drained; Blue Lake—well drained
Seasonal high water table: Morganlake—at a depth of 2.5 to 4.0 feet from October to November and from March to June; Woodman—at a depth of 1.5 to 3.0 feet from October to November and from March to June; Blue Lake—at a depth of more than 6 feet
Surface runoff: Morganlake and Blue Lake—negligible; Woodman—medium
Flooding: None
Hazard of water erosion: Morganlake and Blue Lake—slight; Woodman—moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Morganlake—low in the upper part of the subsoil and moderate in the lower part of the subsoil; Woodman—moderate in the subsoil and low in the sandy substratum; Blue Lake—low
Potential for frost action: Morganlake and Blue Lake—low; Woodman—moderate

Inclusions

Contrasting inclusions:
- Poorly drained Burleigh soils in depressions and drainageways
- Somewhat poorly drained Ingalls soils on the slightly lower landforms

Similar inclusions:
- Areas of Blue Lake soils that have more clay in the subsoil

• Areas of Woodman soils that are loamy to a depth of 60 to 80 inches
• Areas of Woodman soils that have more than 35 percent clay in the subsoil

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Morganlake and Blue Lake—soil blowing, seasonal droughtiness, and low organic matter content; Woodman—water erosion, soil compaction, and tilth of the surface layer
Management measures and considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• The inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the organic matter content.
• Conservation tillage systems, contour farming, cover crops, and sod-based rotations reduce the detachment and loss of nutrients associated with sediment and thus minimize the loss of solid-phase nitrogen and phosphorus.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Morganlake and Blue Lake—seasonal droughtiness and overgrazing; Woodman—compaction and overgrazing
Management measures and considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Morganlake—seasonal wetness and cutbanks cave; Woodman—moderate shrink-swell potential, seasonal wetness, and frost action; Blue Lake—cutbanks cave
Management measures and considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Morganlake—rapid permeability in the upper part of the subsoil, slow permeability in the lower part of the subsoil and in the substratum, and seasonal wetness; Woodman—rapid permeability in the substratum and seasonal wetness; Blue Lake—rapid permeability
Management measures and considerations:
• The poor filtering capacity of the soils can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: Morganlake and Blue Lake—3s; Woodman—3e
Woodland ordination symbol: Morganlake—6S; Woodman—3C; Blue Lake—3A

467C—Morganlake, sandy substratum-Woodman-Blue Lake complex, 6 to 12 percent slopes

Setting

Landform: Knolls and side slopes on kame moraines
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Composition

Morganlake and similar soils: 30 to 50 percent
Woodman soil and similar soils: 20 to 35 percent
Blue Lake soil and similar soils: 20 to 30 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Morganlake

Surface layer:
0 to 6 inches—very dark grayish brown loamy sand

Subsurface layer:
6 to 7 inches—brown loamy sand

Subsoil:
7 to 22 inches—brown and strong brown very friable loamy sand and sand
22 to 35 inches—light brownish gray loamy fine sand surrounding brown friable sandy loam
35 to 49 inches—brown mottled firm fine sandy loam and clay loam

Substratum:
49 to 66 inches—brown sandy clay loam and loam
66 to 80 inches—stratified pale brown and brown sand and sandy loam

Woodman

Surface layer:
0 to 9 inches—very dark grayish brown sandy loam

Subsoil:
9 to 20 inches—pale brown sandy loam surrounding brown firm sandy clay loam
20 to 37 inches—brown mottled firm sandy clay loam
37 to 45 inches—brown firm sandy loam

Substratum:
45 to 56 inches—light brown sandy loam
56 to 80 inches—light yellowish brown sand that has lamellae of brown loamy sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Morganlake—rapid in the sandy material and moderately slow in the loamy material; Woodman—moderately slow in the loamy material and rapid in the underlying sandy material; Blue Lake—moderately rapid
Available water capacity: Morganlake and Blue Lake—low; Woodman—moderate
Drainage class: Morganlake and Woodman—moderately well drained; Blue Lake—well drained
Seasonal high water table: Morganlake—at a depth of 2.5 to 4.0 feet from October to November and from March to June; Woodman—at a depth of 1.5 to 3.0 feet from October to November and from March to June; Blue Lake—at a depth of more than 6 feet
Surface runoff: Morganlake—very low; Woodman—high; Blue Lake—negligible
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Morganlake—low in the upper part of the subsoil and moderate in the lower part of the subsoil; Woodman—moderate in the subsoil and low in the sandy substratum; Blue Lake—low
Potential for frost action: Morganlake and Blue Lake—low; Woodman—moderate

Inclusions

Contrasting inclusions:
• Poorly drained Burleigh soils in depressions and drainageways
• Somewhat poorly drained Ingalls soils on the slightly lower landforms

Similar inclusions:
• Areas of Blue Lake soils that have more clay in the subsoil
• Areas of Woodman soils that are loamy to a depth of 60 to 80 inches
• Areas of Woodman soils that have more than 35 percent clay in the subsoil

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Morganlake and Blue Lake—water erosion, soil blowing, seasonal droughtiness, and low organic matter content; Woodman—water erosion, soil compaction, and tilth of the surface layer

Management measures and considerations:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- The inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the organic matter content.
- Conservation tillage systems, contour farming, cover crops, and sod-based rotations reduce the detachment and loss of nutrients associated with sediment and thus minimize the loss of solid-phase nitrogen and phosphorus.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Morganlake and Blue Lake—seasonal droughtiness and overgrazing; Woodman—compaction and overgrazing

Management measures and considerations:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Woodland

Major management concerns: Plant competition

Management measures and considerations:

- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Morganlake—seasonal wetness, cutbanks cave, and slope; Woodman—moderate shrink-swell potential, seasonal wetness, frost action, and slope; Blue Lake—cutbanks cave and slope

Management measures and considerations:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Morganlake—rapid permeability in the upper part of the subsoil, slow permeability in the lower part of the subsoil and in the substratum, seasonal wetness, and slope; Woodman—rapid permeability in the substratum, seasonal wetness, and slope; Blue Lake—rapid permeability and slope

Management measures and considerations:

- The poor filtering capacity of the soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e

Woodland ordination symbol: Morganlake—6S; Woodman—3C; Blue Lake—3A

468F—Southwells-Mancelona-Dighton complex, 8 to 50 percent slopes, dissected

Setting

Landform: Ridgetops, side slopes, and escarpments on kame moraines
Shape of areas: Irregular
Size of areas: 10 to 170 acres

Composition

Southwells soil and similar soils: 30 to 50 percent
Mancelona soil and similar soils: 20 to 35 percent
Dighton soil and similar soils: 20 to 30 percent
Contrasting inclusions: 0 to 5 percent

Typical Profile

Southwells

Surface layer:
0 to 1 inch—black loamy sand

Subsurface layer:
1 to 3 inches—brown loamy sand

Subsoil:
3 to 13 inches—dark yellowish brown very friable loamy sand
13 to 25 inches—dark brown very friable sand
25 to 57 inches—pale brown loose sand that is surrounded by dark yellowish brown friable loamy sand
57 to 66 inches—dark yellowish brown friable sandy loam that is surrounded by very pale brown very friable loamy sand

Substratum:
66 to 73 inches—yellowish brown sandy loam
73 to 80 inches—brown sand

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Dighton

Surface layer:
0 to 4 inches—very dark gray sandy loam

Subsurface layer:
4 to 8 inches—brown clay loam

Subsoil:
8 to 15 inches—reddish brown firm clay that is mixed with brown clay loam
15 to 26 inches—reddish brown firm clay

Substratum:
26 to 37 inches—brown silty clay
37 to 68 inches—yellowish brown sand that has lamellae of dark brown loamy sand
68 to 80 inches—stratified light yellowish brown sand and gravelly sand

Soil Properties and Qualities

Permeability: Southwells—moderately rapid; Mancelona—moderately rapid in the sandy material and very rapid in the gravelly underlying material; Dighton—slow in the clayey material and rapid in the sandy material
Available water capacity: Southwells and Dighton—moderate; Mancelona—low
Drainage class: Southwells and Dighton—well drained; Mancelona—somewhat excessively drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Southwells and Mancelona—low; Dighton—very high
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Southwells and Dighton—moderate; Mancelona—severe
Shrink-swell potential: Southwells and Mancelona—low; Dighton—moderate in the loamy material and low in the sandy material
Potential for frost action: Southwells and Mancelona—low; Dighton—moderate

Inclusions

Contrasting inclusions:
• Somewhat poorly drained Ingalls soils in swales on the lower landforms

Similar inclusions:
• Areas of Southwells soils that have more clay in the subsoil
• Areas of Dighton soils that are clayey to a depth of 60 inches
• Areas of Mancelona soils that have gravel at a depth of 40 to 60 inches

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Southwells and Mancelona—equipment limitation, erosion hazard, plant competition, and seedling mortality; Dighton—equipment limitation, erosion hazard, and plant competition
Management measures and considerations:
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, or drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Careful planting techniques and planting in spring and fall, when the soil is moist, can help to reduce the seedling mortality rate.
• Planting when the soils are moist can reduce the seedling mortality rate.
• Areas with southern exposure may have higher seedling mortality rates.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management measures and considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Woodland ordination symbol: Southwells and Mancelona—3R; Dighton—3C

469B—Hodenpyl-Montcalm complex, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains
Shape of areas: Irregular
Size of areas: 10 to 230 acres

Composition

Hodenpyl soil and similar soils: 40 to 65 percent
Montcalm soil and similar soils: 25 to 55 percent
Contrasting inclusions: 5 to 10 percent

Typical Profile

Hodenpyl

Surface layer:
0 to 5 inches—very dark gray sandy loam

Subsurface layer:
5 to 14 inches—brown sandy loam

Subsoil:
14 to 20 inches—brown sandy loam surrounding brown friable sandy loam
20 to 38 inches—brown firm sandy loam that is surrounded by brown sandy loam
38 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Montcalm

Surface layer:
0 to 7 inches—dark grayish brown loamy sand

Subsurface layer:
7 to 10 inches—pale brown loamy sand

Subsoil:
10 to 23 inches—dark brown and yellowish brown very friable loamy sand
23 to 46 inches—brown very friable loamy sand that is mixed with dark yellowish brown friable sandy loam
46 to 80 inches—light yellowish brown loose sand that has lamellae of yellowish brown very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Moderate
Drainage class: Well drained

Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Hodenpyl—very low; Montcalm—negligible
Flooding: None
Hazard of water erosion: Hodenpyl—moderate; Montcalm—slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Hodenpyl—moderate; Montcalm—low

Inclusions

Contrasting inclusions:
• Moderately well drained Halfaday soils on the slightly lower landforms

Similar inclusions:
• Areas of Hodenpyl soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
• Areas of Hodenpyl soils where the loamy subsoil is more than 45 inches thick

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Hodenpyl—water erosion, soil blowing, and nutrient and pesticide loss; Montcalm—soil blowing and nutrient and pesticide loss
Management measures and considerations:
• Crop residue management and a cropping sequence that includes close-growing crops help to control water erosion.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: Hodenpyl—2e; Montcalm—3s
Woodland ordination symbol: 3A

471B—Mancelona-Blue Lake complex, 0 to 6 percent slopes

Setting

Landform: Flats and knolls on kame moraines and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 120 acres

Composition

Mancelona soil and similar soils: 40 to 60 percent
Blue Lake soil and similar soils: 35 to 55 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 7 inches—dark grayish brown sand

Subsoil:
7 to 21 inches—strong brown very friable sand
21 to 24 inches—grayish brown loamy sand surrounding reddish brown friable sandy loam
24 to 35 inches—reddish brown friable sandy loam

Substratum:
35 to 80 inches—light yellowish brown very gravelly sand

Blue Lake

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 6 inches—brown loamy sand

Subsoil:
6 to 8 inches—dark reddish brown very friable loamy sand
8 to 27 inches—dark brown and dark yellowish brown very friable and loose sand
27 to 80 inches—pale brown loose sand that has lamellae of strong brown very friable loamy sand

Soil Properties and Qualities

Permeability: Mancelona—moderately rapid in the sandy material and very rapid in the gravelly underlying material; Blue Lake—moderately rapid
Available water capacity: Low
Drainage class: Mancelona—somewhat excessively drained; Blue Lake—well drained
Seasonal high water table: At a depth of more than 6 feet
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Mancelona—severe; Blue Lake—moderate
Shrink-swell potential: Low
Potential for frost action: Low

Inclusions

Contrasting inclusions:
- Moderately well drained Croswell and Halfaday soils on the slightly lower landforms
- Very poorly drained Roscommon soils in depressions

Similar inclusions:
- Areas of Blue Lake soils where the subsoil has less than 6 inches of lamellae
- Areas of Blue Lake soils where the subsoil has thin layers of calcareous gravel below a depth of 60 inches
- Areas of Mancelona soils where the subsoil is lighter in color

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Seasonal droughtiness, nutrient and pesticide loss, soil blowing, and low organic matter content
Management measures and considerations:
- Because of the limited available water capacity, most crops should be irrigated.
- For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- The inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the organic matter content.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Mancelona—equipment limitation, seedling mortality, and plant competition; Blue Lake—plant competition
Management measures and considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management measures and considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Very rapid permeability in the gravelly substratum of the Mancelona soil
Management measures and considerations:
- The poor filtering capacity of the soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Woodland ordination symbol: Mancelona—3S; Blue Lake—3A

472B—Morganlake loamy sand, sandy substratum, 0 to 6 percent slopes

Setting

Landform: Knolls on kame moraines
Shape of areas: Irregular
Size of areas: 10 to 170 acres

Composition

Morganlake soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Typical Profile

Surface layer:
0 to 6 inches—very dark grayish brown loamy sand

Subsurface layer:
6 to 7 inches—brown loamy sand

Subsoil:
7 to 22 inches—brown and strong brown very friable loamy sand and sand
22 to 35 inches—light brownish gray loamy fine sand surrounding brown friable sandy loam
35 to 49 inches—brown mottled firm fine sandy loam and clay loam

Substratum:
49 to 66 inches—brown sandy clay loam and loam
66 to 80 inches—stratified pale brown and brown sand and sandy loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and moderately slow in the loamy material
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 4.0 feet from October to May
Surface runoff: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the sandy part and moderate in the loamy part
Potential for frost action: Low

Inclusions

Contrasting inclusions:
• Blue Lake soils that have sandy lamellae in the subsoil, on landforms similar to those of the Morganlake soil
• Dighton soils that have a loamy surface layer, on landforms similar to those of the Morganlake soil
• Somewhat poorly drained Ingalls soils on the lower landforms

Similar inclusions:
• Areas where the substratum has thin layers of calcareous sand and gravel below a depth of 60 inches

Use and Management

Land Use: Dominant uses—cropland and pasture; other uses—woodland and building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, low organic matter content, and nutrient and pesticide loss
Management measures and considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• The inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the organic matter content.
• Conservation tillage systems, contour farming, cover crops, and sod-based rotations reduce the detachment and loss of nutrients associated with sediment and thus minimize the loss of solid-phase nitrogen and phosphorus.
• For the protection of ground water, nutrients in manure and fertilizer applications should not exceed the plant nutrient requirements.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing
Management measures and considerations:
• Proper stocking rates, uniform distrubution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Plant competition
Management measures and considerations:
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave and moderate shrink-swell potential in the lower part of the subsoil
Management measures and considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Rapid permeability in upper part of the subsoil, moderately slow permeability in the loamy part of the subsoil and in the substratum, and seasonal wetness
Management measures and considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• A subsurface drainage system helps to lower the water table.
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 3s
Woodland ordination symbol: 6S

488A—Allendale sand, 0 to 3 percent slopes

Setting

Landform: Swales and toeslopes on broad plains, on lake plains, and in lake basins
Shape of areas: Irregular
Size of areas: 5 to 65 acres

Composition

Allendale soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 10 inches—brown sand

Subsoil:
10 to 22 inches—dark brown mottled very friable sand
22 to 80 inches—brown mottled very firm silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy material and very slow in the clayey underlying material
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 to 1.0 foot above the surface from September to June
Surface runoff: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low in the sandy upper part of the subsoil and high in the lower part of the subsoil and in the substratum
Potential for frost action: Moderate

Inclusions

Contrasting inclusions:
• Poorly drained Springport soils in depressions and drainageways
• Moderately well drained Kellogg soils in the slightly higher landscape positions

Similar inclusions:
• Areas of Allendale soils where the lower part of the subsoil and the substratum have less clay

Use and Management

Land Use: Dominant uses—cropland and woodland; other uses—pasture and building site development

Cropland

Major management concerns: Seasonal wetness, soil blowing, and seasonal droughtiness
Management measures and considerations:
• Both surface and subsurface drainage systems are needed to reduce the wetness.
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover

crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
• Increasing the organic matter content in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and reduce the risk of ground-water pollution.

Pasture

Major management concerns: Seasonal wetness, overgrazing, and seasonal droughtiness
Management measures and considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
• Skidders should not be used during wet periods, when ruts form easily.
• Access is easiest during periods in winter when access roads are frozen.
• Trees that can withstand seasonal wetness should be selected for planting.
• If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Seasonal wetness, high shrink-swell potential in the clayey lower part of the subsoil and in the substratum, cutbanks cave, and frost action
Management measures and considerations:
• A surface or subsurface drainage system helps to lower the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling or frost action.
• Caving of cutbanks is a concern for shallow excavations. Trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness, very slow permeability in the clayey upper part of the subsoil and in the substratum, and rapid permeability in the sandy part of the subsoil
Management measures and considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• The poor filtering capacity of the soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to minimize possible ground-water pollution.

Interpretive Groups

Land capability classification: 3w
Woodland ordination symbol: 4W

494—Gauld fine sandy loam

Setting

Landform: Flats, depressions, and drainageways on outwash plains, kame moraines, and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to more than 330 acres

Composition

Gauld soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Typical Profile

Surface layer:
0 to 9 inches—black fine sandy loam

Subsoil:
9 to 22 inches—brown and gray mottled friable fine sandy loam

Substratum:
22 to 80 inches—stratified dark gray, grayish brown, and brown mottled sand and sandy loam having layers of silt and silt loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September to June
Surface runoff: Low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Inclusions

Contrasting inclusions:
- Springport soils that have a clayey subsoil, on landforms similar to those of the Gauld soil

Similar inclusions:
- Areas where the soil has a mucky surface layer
- Areas where the soil is flooded

Use and Management

Land Use: Dominant uses—woodland

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, and plant competition
Management measures and considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Landing sites generally can be used only during the driest time of the year.
- Because of the wetness, severe seedling mortality rate, and plant competition, trees are not planted on this soil.
- Windthrow can be minimized by harvesting methods that do not leave the remaining trees widely spaced and by such harvesting methods as selective cutting and strip cutting.
- Special harvesting methods may be needed to control undesirable plants.

Buildings

Major management concerns: Ponding
Management measures and considerations:
- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding and cutbanks cave
Management measures and considerations:
- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Woodland ordination symbol: 2W

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Thirty percent of Kalkaska County, or about 109,509 acres, is active or inactive farmland. Of the total cropland acreage, about 2,850 acres are in row crops and 96,659 acres are in pasture, hay, and small grains *(14)*. Christmas tree farms make up about 10,000 acres. The acreage used for field crops fluctuates from year to year because of anticipated market prices and weather conditions.

Many soil-related management concerns are common to a large number of different soils. The following paragraphs describe the concerns in managing the cropland and pasture in Kalkaska County, including water erosion, soil blowing, seasonal wetness, seasonal doughtiness, soil tilth, and soil fertility.

Water erosion and soil blowing are major management concerns on most of the cropland in the county. The loss of the surface layer through erosion is especially damaging on soils that have a loamy surface layer, such as Woodman and Negwegon, and on soils that tend to be droughty, such as Kalkaska and Blue Lake. Erosion on cropland results in the sedimentation and pollution of streams. Controlling erosion minimizes this pollution and improves the quality of water for municipal and recreational uses and for fish and other wildlife.

Water erosion is a serious hazard on all loamy and clayey soils that have slopes of 2 percent of more. Preparing a good seedbed is difficult on some of the soils because the friable surface layer has been eroded away in places.

Erosion-control practices provide a protective surface cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that includes small grains and forages in the rotation for extended periods reduces the susceptibility to erosion

and preserves the productive capacity of the soil. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence helps to control erosion on the more sloping land, provides nitrogen for subsequent crops, and improves tilth. Conservation tillage helps to control runoff and erosion by leaving protective amounts of crop residue on the surface. Cover crops, diversions, and grassed waterways also help to control erosion.

Soil blowing is a hazard on loamy and sandy soils. An adequate plant cover, surface mulch, vegetative barriers, and tillage methods that leave crop residue on the surface help to control soil blowing.

No-till farming is effective in controlling water erosion and soil blowing because it leaves crop residue on the surface and thus increases the soil's available water capacity in the surface layer. It is suited to most of the soils in the county. Because of no-till farming, eroding areas that otherwise are only marginally productive can become more productive. No-till farming helps to maintain the productive capacity of nearly all cropland. In areas where no-till crops are grown, different methods for planting and for controlling insects and weeds are needed. The proper time for planting, the selection of herbicides that are suited to the existing vegetation, an adequate supply of plant nutrients, and the selection of tillage systems based on soil characteristics are important management requirements.

Much of the permanent pasture in the county is in areas where erosion is a hazard. Erosion control is particularly important when the pasture is seeded. Forage production and the extent to which the plant cover protects the soil surface are influenced by the number of livestock that the pasture supports, the length of time that livestock graze, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the key forage species, pasture rotation, deferred grazing, timely grazing, and the strategic location of water supplies for livestock.

Information about the design and application of erosion-control practices for different soils is available at the local office of the Natural Resources Conservation Service.

Seasonal wetness is a management concern in a few areas used for crops and pasture. Drainage of cropland improves the air-water relationship in the root zone. In areas where drainage is poor, spring planting, spraying, and harvesting are delayed and controlling weeds is difficult. Properly designed subsurface drainage systems or surface drainage systems, or both, can be used to remove excess water.

Unless drained, some soils are naturally so wet that they cannot be used for the crops commonly grown in the county. Unless drained, the very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged in most years. Roscommon, Algonquin, Au Gres, and Allendale soils are examples of very poorly drained and somewhat poorly drained soils. Natural drainage is good in Kalkaska, Montcalm, and Blue Lake soils most of the year. Small areas of the wetter soils along drainageways and in swales are commonly included in some areas of these soils, especially where slopes are 0 to 6 percent. Artificial drainage is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and subsurface drainage is needed in most areas of poorly drained soils that are intensively row cropped. Finding adequate outlets for subsurface drainage systems is difficult in many areas of Springport soils. Diversions can be used to remove surface runoff from some wet areas. Good soil tilth and an ample supply of organic matter also improve drainage. In low-lying areas, the growing season is shortened by frost in late spring and early fall.

In planning drainage, it is important that designated wetlands are not drained and that existing wetland laws and regulations are not violated. Information about the design of drainage systems for each kind of soil is available at the local office of the Natural Resources Conservation Service.

Seasonal doughtiness is a concern in managing Kalkaska, Blue Lake, Islandlake, Montcalm, Au Gres, and Allendale soils. Moisture can be conserved by no-till farming and other kinds of conservation tillage that leave all or part of the crop residue on the surface. Increasing the organic matter content improves the available water capacity. Irrigation improves productivity. The droughty soils and many other soils in the county are suited to irrigation if they are properly managed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Some of the soils used for crops have a loamy surface layer. Generally, the structure of such soils is weak and intense rainfall causes the surface to crust. This crusting hinders the emergence of plant seedlings, decreases the rate of water infiltration, and increases the runoff rate. Regular additions of crop residue, manure, and other organic materials can improve tilth and help to prevent surface crusting. If the soils are plowed when wet, they tend to be very cloddy when dry and become compacted. As a result,

preparing a good seedbed is difficult. Cover crops, green manure crops, proper management of crop residue, conservation tillage, and application of livestock manure help to maintain or improve tilth and the organic matter content. Fall plowing and chisel plowing while the soil is at the proper moisture content can help to prevent deterioration of tilth in nearly level, poorly drained or somewhat poorly drained soils. These practices also allow the soils to be tilled earlier the following spring. Fall plowing is not suitable, however, on sloping soils or on soils that are subject to soil blowing. Good management is needed in intensively cropped areas and in areas that are cultivated year after year.

When loamy or clayey soils are wet, livestock grazing can result in soil compaction and poor tilth. The compaction caused by grazing during wet periods could retard the growth of pasture plants. Proper harvesting methods, such as those for hay or silage, increase plant growth and help to prevent compaction.

Soil fertility is naturally medium or high in loamy soils and low in most sandy soils on uplands. Many sandy soils naturally range from strongly acid to slightly acid. If lime has never been applied to these soils, applications of ground limestone are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potash levels are naturally low or medium in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields *(15)*.

The most common row crops suited to the soils and climate in Kalkaska County are corn, wheat, potatoes, and oats. Alfalfa alone or in mixtures of clover and grasses is the most common hay crop (fig. 11).

Because of the variety of soils, topography, and small micro-climatic changes in the survey area, Kalkaska County is suitable for the production of a variety of vegetables. Vegetable crops include snap beans and potatoes.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(21)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Figure 11.—Hayland in an area of Islandlake loamy sand, 0 to 6 percent slopes.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation.

Class 7 soils have very severe limitations that make them unsuitable for cultivation.

Class 8 soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is

given in the “Detailed Soil Map Units” section and in the yields table.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 8,151 acres in the survey area, or nearly 2 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the southeastern part, mainly in general soil map units 2 and 4, which are described under the heading “General Soil Map Units.” The crops grown on this land are mainly corn, alfalfa hay, and potatoes.

The map units in the survey area that are considered prime farmland are listed in table 6. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading “Detailed Soil Map Units.”

Hydric Soils

In this section, hydric soils are defined and described and the hydric soils in the survey area are listed.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology *(4, 7, 16, 17)*. Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part *(8)*. These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria which identify those estimated soil properties unique to hydric soils have been established *(9)*. These criteria are used to identify a phase of a soil series that normally is associated with wetlands. The criteria used are selected estimated soil properties that are described in “Soil Taxonomy” *(22, 24)* and in the “Soil Survey Manual” *(23)*.

If soils are wet enough for a long enough period to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators that can be used to make onsite determinations of hydric soils in this survey area are specified in “Field Indicators of Hydric Soils in the United States” *(19)*.

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described

as deep as necessary for an understanding of the redoximorphic processes. Then, using the completed soil description, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if one (or more) of the approved indicators is present.

This survey can be used to locate probable areas of hydric soils.

The following map units are composed of soils or have major components of soils in the map unit that meet the definition of hydric soils and, in addition, have at least one of the hydric soil indicators. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site *(16, 19)*.

13	Tawas-Lupton mucks
14	Dawson-Loxley peats
19	Leafriver muck
23	Ausable-Bowstring mucks, frequently flooded
24A	Kinross-Au Gres complex, 0 to 3 percent slopes
35	Kinross muck
50B	Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes
51	Tawas-Leafriver mucks
58A	Wakeley-Allendale complex, 0 to 3 percent slopes
86	Histosols and Aquents, ponded
87	Ausable muck, frequently flooded
99	Roscommon mucky sand
174A	Au Gres-Roscommon complex, 0 to 3 percent slopes
360	Wakeley muck
371	Springport silt loam
412A	Ingalls-Burleigh loamy sands, 0 to 3 percent slopes
461A	Allendale-Springport complex, 0 to 3 percent slopes
494	Gauld fine sandy loam

Map units that are made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions of the landform, and map units made up of nonhydric soils may have inclusions of hydric soils in the lower positions of the landform.

The following map units, in general, do not meet the definition of hydric soils because they do not have one of the hydric soil indicators. A portion of these map units, however, may include hydric soils. Onsite investigation is recommended to determine if hydric soils occur and the location of the included hydric soils.

15A	Croswell-Au Gres sands, 0 to 3 percent slopes
18A	Au Gres sand, 0 to 3 percent slopes
20B	Graycalm-Grayling complex, 0 to 6 percent slopes
21B	Graycalm-Klacking complex, 0 to 6 percent slopes
26B	Cublake sand, 0 to 6 percent slopes
28B	East Lake sand, 0 to 6 percent slopes
48B	Rubicon-Graycalm sands, 0 to 6 percent slopes
49B3	Kalkaska sand, 0 to 6 percent slopes, severely eroded
53B	Negwegon silt loam, 2 to 6 percent slopes
54A	Algonquin silt loam, 0 to 3 percent slopes
75B	Rubicon sand, 0 to 6 percent slopes
81B	Grayling sand, 0 to 6 percent slopes
147B	Linquist sand, 0 to 6 percent slopes
159A	Finch sand, 0 to 3 percent slopes
197A	Gladwin loamy sand, 0 to 3 percent slopes
338B	Islandlake sand, 0 to 6 percent slopes
366B	Islandlake-Blue Lake complex, 0 to 6 percent slopes
402B	Islandlake loamy sand, 0 to 6 percent slopes
406A	Winterfield loamy sand, 0 to 2 percent slopes, rarely flooded
460B	Rubicon, calcareous substratum-Mancelona sands, 0 to 6 percent slopes
462A	Allendale-Algonquin complex, 0 to 3 percent slopes
467B	Morganlake, sandy substratum-Woodman-Blue Lake complex, 1 to 6 percent slopes
467C	Morganlake, sandy substratum-Woodman-Blue Lake complex, 6 to 12 percent slopes
471B	Mancelona-Blue Lake complex, 0 to 6 percent slopes
488B	Allendale sand, 0 to 3 percent slopes

Woodland Management and Productivity

Carl Eckland, District Forester, prepared this section.

When settlers first arrived in the survey area, the land was almost completely forested, except for natural or fire-cleared openings. Logging of the vast pine forests began around 1875 and was followed by logging of the hardwoods in 1890. Lumbering peaked around 1910. After the decline of the forest industry, many once forested areas were cleared and converted to agriculture. Beginning in the late 1940’s, many agriculturally marginal areas were planted to red pine (Norway pine), white pine, and white spruce. Many of these plantings were unmerchantable in the past, but new industries are utilizing smaller and smaller trees.

Many of the pine plantations have had at least one thinning, and a majority will have had a second cut by the year 2000. After the original clearing of the hardwood forest, most hardwood stands naturally regenerated. Many of these stands are merchantable at the present time, and most have had some cutting.

Gypsy moth defoliation is becoming a major forest problem in most of northern Michigan and is continuing to spread throughout the state. The impact of forest defoliation on our forest resources is not yet known.

Forest Cover Types

Jack Pine Forest Cover Type.—This forest type covers approximately 27,000 acres. Associated trees include red pine, eastern white pine, bigtooth aspen, red oak, white oak, and pin oak. This type occurs predominantly on Rubicon, Grayling, and Croswell soils. These soils are sandy, occur on nearly level to very steep terrain, and are excessively drained to moderately well drained. The droughty and less fertile areas support mainly jack pine and pin oak. The soils that have a water table at a depth of 3.5 to 15 feet produce good stands of quality red pine and white pine. Seedling survival is fair to excellent and mainly dependent on weather conditions during the period of seedling establishment.

Oak-Red Maple Forest Cover Type.—This forest type covers approximately 15,000 acres. Associated trees include red pine, eastern white pine, bigtooth aspen, and paper birch. The original forest cover type was mainly eastern white pine. Logging completely removed the white pine, and subsequent fires converted the forest to the oak-red maple type. This type occurs predominantly on Graycalm, Klacking, and Rubicon soils. These soils are nearly level to very steep, excessively drained to well drained, sandy and loamy. Seedling survival is good to excellent. Red pine was planted on many of these soils when farming became unfeasible.

Sugar Maple-Beech Forest Cover Type.—This forest type covers approximately 121,000 acres. Sugar maple is the most dominant species, and American basswood is common. Associated trees include eastern hemlock, eastern white pine, white ash, red oak, ironwood, and bigtooth aspen. This type occurs on Islandlake, Southwells, and Morganlake, sandy substratum, soils. These are the most productive soils. The type also occurs on Kalkaska, Springlake, and Blue Lake soils. The soils are sandy, occur on nearly level to very hilly sites, and are excessively drained to well drained.

The majority of these soils were cleared for farmland after logging removed most of the timber. Many areas were replanted to red pine and white pine, and good-quality stands were produced. The highest quality hardwoods are growing on the steeper soils mainly because of the difficulty of harvesting or farming these areas in the past. More recently, however, because of an increased demand for sugar maple and better technology, the majority of these areas are harvestable. Christmas trees are also a large component of the forests on these soils.

Red Maple-Balsam Fir Forest Cover Type.—This forest type covers approximately 6,000 acres. These areas are comprised of lowland hardwoods and conifers with a mixture of species. Associated trees include paper birch, white spruce, quaking aspen, sugar maple, American elm, eastern hemlock, and black cherry. American elm shared dominance with the maples, but most of the elms have died from Dutch Elm Disease. This cover type occurs on Croswell, Au Gres, and Roscommon soils. These soils are nearly level, moderately well drained to very poorly drained, and sandy.

Aspen Forest Cover Type.—This forest type covers approximately 45,000 acres. Quaking aspen and bigtooth aspen are dominant. Associated trees include white pine, red pine, balsam fir, red oak, red maple, paper birch, and pin cherry. Aspen stands occur on all previously mentioned soils as well as on Algonquin, Allendale, and Negwegon soils. Aspen grows on sites that have had a major disturbance, such as in cutover timber stands, in burned areas, or in abandoned farm fields. Aspen stands, if left undisturbed, revert to pine stands or northern hardwoods, resulting in many stands with a variety of species. In areas where aspen has been harvested, pure large stands exist. Ten- to twenty-acre stands are very common on most soil types. Soil productivity is the main limiting factor in aspen growth.

Northern White Cedar-Lowland Conifer Forest Cover Type.—This forest type covers approximately 18,000 acres. Associated trees include balsam fir, white spruce, eastern hemlock, black ash, and red maple. This cover type occurs on Lupton, Tawas, and Ausable soils. These soils are nearly level, very poorly drained, and mucky and sandy. Tree growth on these soils is slow, and water tables remain at or near the surface the majority of the time. Deer browsing, overcutting, and beaver floodings are drastically changing this forest type. Balsam fir and tag alders dominate previous white cedar sites. Regeneration methods are not adequate in areas of large deer populations.

Figure 12.—Woodland production of pulpwood for paper or fiber is an important economic enterprise in Kalkaska County.

Forest Products

Forest products are a major contributor to the economy of Kalkaska County. Hardwood sawlogs, pulpwood, Christmas trees, firewood, and red pine poles are the main products (fig. 12). Because of increasing pressures on this resource, care must be taken in any management decision in order to ensure a sustained balanced forest for future generations.

Sawlogs.—Kalkaska County has fair to excellent quality hardwoods. Many stands are being actively managed by a selective cutting procedure; however, the majority of the stands are being high graded and clearcut due to the increased value of sugar maple in the market place. Most of the northern hardwood types have the potential to produce high-quality lumber if managed properly. Many stands are still in need of improvement cuts in order to remove cull or defective trees. Market trends and changes in technology will most likely increase the management of these stands. Most hardwood stands are managed by an uneven-aged or selective cutting system.

Pulpwood.—Aspen and jack pine are the two most important pulp species. Recently, however, almost all wood species have been marketed for pulp. In addition, fuel chips have recently changed the demand for wood fiber to meet increasing demands for the four Co-generation plants in the greater Kalkaska area. Most pulpwood cuts are based on an even-aged management system or clear-cut method. This is due to the vigorous sprouting ability of aspen. Jack pine is clearcut and replanted, or the area is burned if conditions are good for the natural regeneration of jack pine.

Christmas trees.—Pine, spruce, and fir have been planted for several decades in Kalkaska County. Until recently, Scotch pine was the most widely planted species. Because of recent problems with disease control, gypsy moth, increased competition from southern states, and an overall glut of Scotch pine, the market is changing. Most Christmas tree species are planted on idle farm fields. The average age of harvest is 7 to 8 years for pines and 10 to 12 years for spruce.

Firewood.—Firewood is an important source of income for many families in Kalkaska County. Unmerchantable tops from logging operations as well

as Timberland Stand Improvement (TSI) cuts provide the bulk of firewood needs. Sugar maple and oak are the most important sources of firewood, but most species are utilized.

Red pine poles.—Red pine was planted extensively in the county on marginal farmlands starting in the late 1940's. To date there are approximately 40,000 acres of plantation red pine in the county. These stands began reaching merchantable size in the early 1980's. Many stands have now had a second thinning. Red pine seedlings are easy to transplant and generally have excellent survival rates on most soils, even in droughty years. Plantation pine is managed by removing one-third of the stand (general every third row) at an age of 30 to 35 years and then through selective harvesting, removing one-third of the stand every 10 years thereafter with an end rotation age of approximately 70 years. Utility poles and cabin logs are the highest value products at present. Because of the abundance of pine in northern Michigan, however, many new industries are competing for this resource.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce in a pure stand under natural conditions. The number 1 indicates low potential productivity; 2 or 3, moderate; 4 or 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, rockiness; *W*, excess water in or on the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, L, and N.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restriction that affects rooting is a seasonal high water table, or other limiting layer. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A

rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hinder stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

The *volume of wood fiber*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Suggested trees to plant are those that are suitable for commercial wood production.

Logging and harvesting of wood resources are important to the economy of Kalkaska County. Table 8 provides expanded information concerning the operability of harvesting equipment. The table gives information about operating harvesting or thinning equipment in logging areas and on skid roads, on log landings, and on haul roads. Limitations are given for the most limiting season and for the preferred operating season. The most limiting season in this survey area, generally, is spring or late fall. In some areas, however, logging during dry periods, such as summer, is also limiting. Loose sand can limit trafficability on excessively drained to well drained, sandy soils.

The preferred operating season is the period when harvesting or thinning causes the least amount of soil damage. This period generally is when the soil is not too wet or when the ground is frozen or partially frozen or has adequate snow cover.

In table 8, a rating of *slight* indicates that the use of conventional logging equipment is not restricted if normal logging methods are used. A rating of *moderate* indicates that the use of equipment is restricted because of one or more soil factors. If wetness is a limitation, high flotation equipment or special procedures may be needed to prevent the formation of ruts. A rating of *severe* indicates that the kind of equipment that can be used is seriously restricted.

Logging areas and skid roads include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid roads, which generally are within the logging area, are roads or trails over which the logs are dragged or hauled to a log landing.

Log landings are areas where logs are assembled for transportation. Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging.

Haul roads are access roads leading from primary or surfaced roads to the logging areas. The logging roads serve as transportation routes for wheeled logging equipment and logging trucks. Generally, they are unpaved roads. Some are gravelled.

Soils and Associated Plant Communities

Table 9 list plants that are typically associated with soils in the survey area. The plants listed in the table are the result of sample site information. Sample sites were selected for vegetative analysis after detailed soils maps and soil series descriptions were completed in an area. Once the soils were verified, representative vegetative communities were selected which were relatively free from noticeable insect or disease infestations. The sample sites were located in areas that exhibited mid to late stages of forest succession and had typical stocking densities.

The size of the plots sampled was approximately 100 square feet. Plant species were identified and recorded, and an occular estimate was made of the percent coverage for each species. Tree species were recorded by estimating the percent canopy coverage, and other plants were recorded by estimating the percent ground coverage. Coverage values were grouped into seven classes to facilitate compilation and to clarify results. The seven classes are: *1*, indicating less than 1 percent coverage; *2*, indicating 1

to 5 percent coverage; *3*, indicating 5 to 25 percent coverage; *4*, indicating 25 to 50 percent coverage; *5*, indicating 50 to 75 percent coverage; *6*, indicating 75 to 95 percent coverage; and *7*, indicating 95 to 100 percent coverage.

The number after each plant species in table 9 represents the mean coverage class for that species for the map unit or soil listed. This number can be correlated to the relative dominance of overstory and understory vegetation. Plants that have a high number cover more of the canopy or ground than those with a low number.

The plants listed in table 9 for each map unit are a composite of two to ten sample sites. They are considered the typical plants found in the map unit. They are not, however, the only plants that can be found in the map unit areas. Only common names are used for the plants in the table. The common names are those used in the national list of plant names *(25)*.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in the table are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Kalkaska County provides numerous opportunities for recreation. About 255,521 acres are forestland, there are more than 80 inland lakes, and there are more than 225 miles of streams and rivers *(10)*.

Kalkaska County has 147,984 acres of State-owned land suitable for fishing, hunting, boating, camping, picnicking, hiking, horseback riding trails, swimming, snowmobiling, and cross-country skiing.

Other recreational areas include county parks, three golf courses, and private campgrounds.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones, absorbs rainfall readily but remains firm, and is not dusty when dry.

Strong slopes and stones can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Kalkaska County has a diverse population of wildlife. The principal types of wildlife include white-tail deer, black bear, tree squirrels, red fox, coyotes, bobcats, mink, muskrat, cottontail rabbits, snowshoe hares, ruffed grouse, wild turkeys, hawks, and numerous songbirds. Wetland wildlife includes many species of waterfowl, including Sandhill cranes. Many lakes and streams in the county contain northern pike, walleye, largemouth bass, bluegills, sunfish, and crappies. The rivers and streams contain trout and steelhead.

Habitat for wildlife in Kalkaska County ranges from farmland to woodland. In many areas, wildlife habitat can be improved by increasing plantings of the appropriate vegetation in order to provide adequate food and cover for wildlife.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting the appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness,

surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, ferns, wild leeks, and sweet cicely.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, hawthorn, dogwood, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattails, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank

absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable

for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one

place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, and slopes of 15 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, and a water table. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They have little or no gravel and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome;

moderate if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table and the permeability of the aquifer.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on permeability, depth to a high water table or depth of standing water if the soil is subject to ponding, slope, susceptibility to flooding, subsidence of organic layers, and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by slope and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading “Soil Series and Their Morphology.”

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Tables 18 and 19 show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In table 18, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^{1}/_{3}$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In table 18, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K_{sat}) refers to the ability of a soil to transmit water or air. The term “permeability,” as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in inches per hour, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility, or shrink-swell potential, is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, more than 6 percent; and *very high*, greater than 9 percent.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factors K and Kf indicate the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.64. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Factor K considers the whole soil and factor Kf considers only the fine-earth fraction, the material of less than 2.00 millimeters equivalent diameter. For most soils Kf equals K. If rock fragments are substantial, they have an armoring effect, and the K factor should be adjusted downward. Because of the armoring affect on gravelly soils, there is less splash erosion and the K is therefore less than the Kf.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility of soil to blowing. The soils assigned to group 1 are the most susceptible to soil blowing, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to blowing, or the tons per acre per year that can be expected to be lost to soil blowing. There is a close correlation between soil blowing and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence soil blowing.

In table 19, *cation-exchange capacity* is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5. Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Water Features

Tables 20 and 21 give estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Soil moisture status is an estimate of the fluctuating water content in a soil. It greatly influences vegetation type, root growth, and germination; excavation, construction, and trafficability; chemical interactions, transport, and contamination; and soil strength, shrinking and swelling, and frost action. It is important to wetland and wildlife habitat classification as well as to crop management.

Table 20 gives estimates of soil moisture for each map unit at various depths for every month of the year. *Moist* signifies the moisture condition where soil water is most available for plant growth. *Dry* signifies the moisture status where most plants (especially crops) cannot extract water for growth. A *wet* status indicates a condition where free water will stand in an unlined hole or a condition that is at least too wet for agricultural species to grow. A moisture rating of *0.0-6.5: Moist* indicates (if it is a typical year) that the soil is moist from the soil surface to a depth of 6.5 feet during the month designated. Summer months may show the effects of drying plus intermittent light rains that would produce a moist surface underlain by a dry layer which becomes moist again as depth increases.

In table 21, *hydrologic soil groups* are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups, the first letter is for drained areas and the second is for undrained areas.

Water table refers to a saturated zone in the soil. Table 21 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 21 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions

(the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Features

Table 22 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 22 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20, 22)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 23 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Spodsol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquod (*Aqu*, meaning water, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Endoaquods (*Endo*, meaning saturation in all layers plus *aquod*, the suborder of the Spodosols that has a aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Endoaquods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, frigid Typic Endoaquods.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” *(23)*. Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” *(22)* and in “Keys to Soil Taxonomy” *(20)*. Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section “Detailed Soil Map Units.”

Algonquin Series

The Algonquin series consists of somewhat poorly drained, very slowly permeable soils on lake plains. These soils formed in silty and clayey glaciolacustrine deposits. Slope ranges from 0 to 3 percent. The soils are classified as fine, mixed, semiactive, frigid Aquic Hapludalfs.

Typical pedon of Algonquin silt loam, 0 to 3 percent

slopes; 1,450 feet south and 75 feet west of the northeastern corner of sec. 31, T. 28 N., R. 8 W.; USGS Torch River topographic quadrangle; lat. 44 degrees 47 minutes 54 seconds N. and long. 85 degrees 18 minutes 42 seconds W.; Clearwater Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 6/1) dry; moderate medium granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

Bt1—9 to 18 inches; dark yellowish brown (10YR 4/4) silty clay; strong coarse prismatic structure parting to strong fine angular blocky; firm; common fine and medium roots; many brown (10YR 5/3) clay films on faces of peds; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; many very dark gray (10YR 3/1) organic stains along root channels and pores; many coarse distinct gray (10YR 6/1) iron depletions and common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; slightly effervescent; slightly alkaline; clear wavy boundary.

Bt2—18 to 36 inches; reddish brown (5YR 5/3) silty clay; strong coarse prismatic structure parting to strong medium angular blocky; firm; few fine roots; thick brown (10YR 5/3) clay films on faces of peds; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; few very dark gray (10YR 3/1) organic stains along root channels and pores; many common distinct greenish gray (5GY 5/1) iron depletions and common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries along root channels on faces of peds; strongly effervescent; moderately alkaline; clear wavy boundary.

BC—36 to 80 inches; reddish brown (5YR 5/3) clay; strong coarse prismatic structure; very firm; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation and many coarse prominent greenish gray (5BG 6/1) iron depletions with sharp boundaries along root channels and on faces of peds; few masses of white (10YR 8/1) calcium carbonate; strongly effervescent; moderately alkaline.

The content of gravel ranges from 0 to 3 percent and the content of cobbles ranges from 0 to 2 percent throughout the profile. Depth to free calcium carbonates ranges from 24 to 32 inches. Depth to redoximorphic accumulations and depletions ranges from 7 to 15 inches. The clay content ranges from 35 to 60 percent in the argillic horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly silt loam but the range includes loam.

The Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay or silty clay loam.

The BC horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 or 4. It is clay or silty clay.

Allendale Series

The Allendale series consists of somewhat poorly drained soils on lake plains. These soils formed in sandy deposits over clayey glaciolacustrine deposits. Permeability is rapid in the upper sandy material and very slow in the clayey underlying material. Slope ranges from 0 to 3 percent. The soils are classified as sandy over clayey, mixed, semiactive, frigid Alfic Epiaquods.

Typical pedon of Allendale sand in an area of Allendale-Algonquin complex, 0 to 3 percent slopes (fig. 13); 1,050 feet west and 1,700 feet south of the northeastern corner of sec. 1, T. 15 N., R. 15 W.; USGS Sharon topographic quadrangle; lat. 44 degrees 35 minutes 30 seconds N. and long. 85 degrees 5 minutes 49 seconds W.; Garfield Township:

A—0 to 2 inches; black (N 2/0) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine, medium, and coarse roots; very strongly acid; abrupt wavy boundary.

E—2 to 10 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 7/2) dry; weak fine granular structure; very friable; few fine to coarse roots; few very dark gray (10YR 3/1) organic stains; about 3 percent fine gravel; strongly acid; abrupt wavy boundary.

Bs—10 to 22 inches; brown (7.5YR 4/4) sand; weak fine granular structure; very friable; few fine to coarse roots; dark reddish brown (5YR 3/3) and yellowish red (5YR 4/6) ortstein occupies 45 percent of the horizon and is weakly to strongly cemented; ortstein occurs as a horizontal, nearly continous layer; common medium distinct strong brown (7.5YR 4/6) masses of iron accumulation and few fine distinct dark reddish gray (5YR 4/2) iron depletions with sharp boundaries along root channels and on faces of peds; about 8 percent fine gravel; strongly acid; abrupt wavy boundary.

2Bt—22 to 30 inches; brown (10YR 4/3) silty clay; strong coarse angular blocky structure parting to moderate medium subangular blocky; very firm; few fine roots; few fine vesicular and tubular pores; common dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds;

common medium distinct dark yellowish brown (10YR 4/4) masses of iron accumulation and many medium prominent (5GY 6/1) masses of iron depletion with sharp boundaries on faces of peds; neutral; gradual wavy boundary.

2BC—30 to 80 inches; brown (10YR 5/3) silty clay; strong coarse prismatic structure; very firm; few fine roots; few fine vesicular and tubular pores; common dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; common medium distinct gray (5GY 6/1) masses of iron depletion with sharp boundaries on faces of peds; common masses of very pale brown (10YR 8/2) calcium carbonates; strongly effervescent; moderately alkaline.

The depth to the agrillic horizon and free calcium carbonates ranges from 20 to 40 inches. The clay content ranges from 35 to 60 percent in the argillic horizon. The content of gravel ranges from 0 to 8 percent in the A, E, and Bs horizons and is 0 or 1 percent in the 2Bt and 2BC horizons. The depth to redoximorphic accumulations and depletions ranges from 7 to 15 inches. The Bs horizon has 10 to 45 percent ortstein.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly sand but the range includes loamy sand.

The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 3. It is sand or loamy sand.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 4. It is sand.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay or clay.

The 2BC horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is silty clay.

Aquents

Aquents consists of very poorly drained, rapidly permeable soils on outwash plains, lake plains, and kame moraines. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Aquents in an area of Histosols and Aquents, ponded; 800 feet south and 20 feet east of the northwestern corner of sec. 32, T. 26 N., R. 6 W.; USGS Sharon topographic quadrangle; lat. 44 degrees 36 minutes 34 seconds N. and long. 85 degrees 4 minutes 21 seconds W.; Oliver Township:

A—0 to 5 inches; very dark gray (10YR 3/1) muck, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine and medium roots; slightly acid; abrupt wavy boundary.

Cg1—5 to 8 inches; olive gray (5Y 5/2) loamy fine sand; weak fine subangular blocky structure; friable; few fine roots; common black (10YR 2/1) organic stains along root channels and pores; neutral; clear wavy boundary.

Cg2—8 to 80 inches; light gray (2.5Y 7/2) sand; single grain; loose; few fine roots; neutral.

The content of fine gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly mucky loamy fine sand but the range includes sand. Some pedons have a thin Oa horizon.

The C horizon has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 to 4. It is loamy fine sand, sand, or loamy sand.

Au Gres Series

The Au Gres series consists of somewhat poorly drained, rapidly permeable soils on outwash plains, kame moraines, stream terraces, and lake plains. These soils formed in sandy deposits. Slope ranges from 0 to 3 percent. The soils are classified as sandy, mixed, frigid Typic Endoaquods.

Typical pedon of Au Gres sand, 0 to 3 percent slopes; 1,100 feet north and 1,120 feet west of the southeastern corner of sec. 20, T. 27 N., R. 7 W.; USGS Kalkaska topographic quadrangle; lat. 44 degrees 43 minutes 0 seconds N. and long. 85 degrees 11 minutes 27 seconds W.; Kalkaska Township:

A—0 to 3 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine and few medium roots; moderately acid; abrupt wavy boundary.

E—3 to 9 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/1) dry; weak fine granular structure; very friable; common coarse and medium and few fine roots; about 1 percent fine gravel; very strongly acid; clear irregular boundary.

Bhs—9 to 13 inches; dark reddish brown (5YR 3/3) sand; weak fine granular structure; very friable; few fine and medium roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/2) and yellowish red (5YR 4/6) ortstein 2 to 6 inches wide extend into the Bs horizon; ortstein columns are 3 to more than 40 inches apart; ortstein occupies 14 percent of the horizon; few fine prominent pale brown (10YR 6/3) masses of iron depletion with diffuse boundaries along root channels and on faces of peds; about 3

percent fine gravel; very strongly acid; clear wavy boundary.

Bs—13 to 24 inches; brown (7.5YR 4/4) sand; single grain; loose; few fine and medium roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/2) and yellowish red (5YR 4/6) ortstein 3 to 7 inches wide extend into this horizon from the Bhs horizon; ortstein columns are 3 to more than 40 inches apart; ortstein occupies 30 percent of the horizon; many common prominent pale brown (10YR 6/3) masses of iron depletion and many coarse prominent yellowish brown (10YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; about 3 percent fine gravel; very strongly acid; clear wavy boundary.

C1—24 to 30 inches; yellowish brown (10YR 5/4) sand; single grain; loose; many coarse distinct pale brown (10YR 6/3) masses of iron depletion with sharp boundaries on faces of peds; about 3 percent fine gravel; very strongly acid; clear wavy boundary.

C2—30 to 33 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; many fine distinct light brownish gray (10YR 6/2) masses of iron depletion with diffuse boundaries on faces of peds; about 5 percent fine gravel; moderately acid; clear wavy boundary.

C3—33 to 80 inches; light brownish gray (10YR 6/2) sand; single grain; loose; about 5 percent fine gravel; slightly acid.

The content of fine gravel ranges from 0 to 10 percent throughout the profile. The depth to redoximorphic accumulations and depletions ranges from 8 to 18 inches. Ortstein makes up 0 to 45 percent of the Bs horizon.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2, or it is neutral in hue has value of 2 to 4. It is sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 to 3. It is sand.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is sand.

The Bs horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 8. It is sand.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 6. It is sand.

Ausable Series

The Ausable series consists of very poorly drained soils on flood plains. These soils formed in herbaceous material that is 8 to 16 inches thick over sandy alluvium. Permeability is moderate or moderately rapid in the organic material and rapid in the sandy material. Slope ranges from 0 to 2 percent. The soils are classified as sandy, mixed, frigid Histic Humaquepts.

Typical pedon of Ausable muck in an area of Ausable-Bowstring mucks, frequently flooded; 1,560 feet south and 2,010 feet east of the northwestern corner of sec. 24, T. 28 N., R. 5 W.; USGS Frederic topographic quadrangle; lat. 44 degrees 48 minutes 31 seconds N. and long. 84 degrees 51 minutes 35 seconds W.; Blue Lake Township:

Oa1—0 to 6 inches; dark brown (7.5YR 3/2) broken face and rubbed muck; about 70 percent fiber, 10 percent rubbed; massive; many fine and few medium roots; strongly acid; abrupt smooth boundary.

Oa2—6 to 11 inches; black (N 2/0) broken face and rubbed muck; about 20 percent fiber, 5 percent rubbed; massive; friable; few fine roots; moderately acid; abrupt smooth boundary.

Cg1—11 to 38 inches; light brownish gray (10YR 6/2) sand; single grain; loose; many black (10YR 2/1) organic stains along root channels; about 2 percent fine gravel; slightly acid; clear wavy boundary.

Cg2—38 to 80 inches; grayish brown (10YR 5/2) sand; single grain; loose; thin horizontal layers of black (10YR 2/1) and very dark gray (10YR 3/1) organic stains 1 to 3 inches thick; about 5 percent fine gravel; neutral.

The thickness of the sapric material ranges from 16 to 51 inches. The Oe and Oa horizons are derived from herbaceous material. The content of woody fragments ranges from 0 to 5 percent in the Oa horizon. In the Cg horizon, the content of fine and medium gravel ranges from 0 to 14 percent and the content of cobbles ranges from 0 to 5 percent.

The Oe or Oa horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is muck.

The Cg horizon has hue of 10YR, value of 4 to 6, and chroma 1 to 3. It is sand.

Blue Lake Series

The Blue Lake series consists of well drained, moderately rapidly permeable soils on kame moraines, remnant moraines, and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 35 percent. The soils are classified as sandy, mixed, frigid Lamellic Haplorthods.

Typical pedon of Blue Lake loamy sand in an area

of Islandlake-Blue Lake complex, 0 to 6 percent slopes (fig. 14); 2,330 feet north and 2,550 feet west of the southeastern corner of sec. 16, T. 26 N., R. 7 W.; USGS Kalkaska topographic quadrangle; lat. 44 degrees 38 minutes 48 seconds N. and long. 85 degrees 9 minutes 55 seconds W.; Orange Township:

A—0 to 2 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; common fine and medium roots; about 1 percent fine gravel; very strongly acid; abrupt wavy boundary.

E—2 to 6 inches; brown (7.5YR 5/2) loamy sand, light gray (10YR 7/1) dry; weak medium granular structure; very friable; common fine and medium and few coarse roots; about 1 percent fine gravel; strongly acid; clear irregular boundary.

Bhs—6 to 8 inches; dark reddish brown (5YR 3/2) loamy sand; weak medium granular structure; very friable; common medium and coarse and few fine roots; about 1 percent fine gravel; strongly acid; abrupt broken boundary.

Bs1—8 to 16 inches; dark brown (7.5YR 3/4) sand; weak medium granular structure; very friable; few fine, medium, and coarse roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/3) ortstein 2 to 6 inches wide extend into the Bs2 horizon; ortstein columns are 3 to more than 40 inches apart; ortstein occupies 20 percent of the horizon; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs2—16 to 27 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; few fine roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/3) ortstein 2 to 6 inches wide; ortstein columns are 3 to more than 40 inches apart; ortstein occupies 15 percent of the horizon; about 3 percent fine gravel; moderately acid; abrupt broken boundary.

E and Bt—27 to 80 inches; pale brown (10YR 6/3) sand, light gray (10YR 7/2) dry (E part); single grain in E part; loose in E part; lamellae of strong brown (7.5YR 4/6) loamy sand (Bt part); lamellae are $^1/_8$ to 1 inch thick; accumulation of lamellae is more than 6 inches thick; weak fine granular structure in Bt part; very friable in Bt part; clay bridging between sand grains; about 5 percent fine gravel; moderately acid.

The content of fine gravel ranges from 0 to 10 percent and the content of cobbles ranges from 0 to 5 percent throughout the profile. The depth to the first lamellae ranges from 20 to 35 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly loamy sand but the range includes sand. An Ap horizon, if it occurs, has hue of 10YR, value of 3 or 4, and chroma of 2.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2. It is loamy sand or sand.

The Bhs horizon has hue of 5YR and value and chroma of 2 or 3. It is loamy sand or sand.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 6. It is sand or loamy sand.

The E part of the E and Bt horizon has colors and textures similar to those of the E horizon. The B part of the E and Bt horizon has lamellae $^1/_8$ inch to 6 inches thick, and the accumulation of lamellae is more than 6 inches thick. The B part has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand or sandy loam.

Bowstring Series

The Bowstring series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils on flood plains. These soils formed in 16 to 51 inches of herbaceous material over alternating layers of mineral and organic alluvium. Slope ranges from 0 to 2 percent. The soils are classified as euic, frigid Fluvaquentic Haplosaprists.

Typical pedon of Bowstring muck in an area of Ausable-Bowstring mucks, frequently flooded; 1,600 feet north and 1,800 feet west of the southeastern corner of sec. 16, T. 26 N, R. 8 W.; USGS South Boardman topographic quadrangle; lat. 44 degrees 38 minutes 44 seconds N. and long. 85 degrees 16 minutes 44 seconds W.; Boardman Township:

Oa1—0 to 18 inches; black (N 2/0) broken face and rubbed muck, black (10YR 2/1) dry; about 5 percent fiber, less than 1 percent rubbed; weak medium granular structure; friable; many fine, common medium, and few coarse roots; about 3 percent mineral material; neutral; abrupt smooth boundary.

Oa2—18 to 21 inches; black (5YR 2/1) broken face and rubbed muck; about 10 percent fiber, less than 1 percent rubbed; massive; friable; few fine roots; neutral; abrupt wavy boundary.

Oa3—21 to 37 inches; black (N 2/0) broken face and rubbed muck; about 5 percent fiber, less than 1 percent rubbed; massive; friable; common thin strata $^1/_4$ to 1 inch thick of light brownish gray (10YR 6/2) sand; about 2 percent woody fragments; neutral; abrupt smooth boundary.

C—37 to 47 inches; light brownish gray (10YR 6/2) sand; single grain; loose; many thin strata $^1/_4$ to 1

inch thick of black (N 2/0) muck; about 5 percent woody fragments; neutral; abrupt smooth boundary.

O´a—47 to 80 inches; black (5YR 2.5/1) broken face and rubbed muck; about 5 percent fiber, less than 1 percent rubbed; massive; friable; common thin strata 1/4 to 1 inch thick of light brownish gray (10YR 6/2) sand; neutral.

The content of woody fragments ranges from 0 to 10 percent throughout the profile. Depth to mineral layers ranges from 16 to 40 inches. Organic fibers are derived primarily from herbaceous material. The thickness and sequence of organic layers vary in the control section.

The Oa horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is muck.

The C horizon has hue of 10YR to 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sand.

Burleigh Series

The Burleigh series consists of poorly drained soils on lake plains. They formed in sandy deposits over stratified loamy and sandy glaciolacustrine deposits. Permeability is rapid in the sandy upper material and moderately rapid in the loamy underlying material. Slope ranges from 0 to 2 percent. The soils are classified as sandy over loamy, mixed, nonacid, active, frigid Mollic Endoaquents.

Typical pedon of Burleigh loamy sand in an area of Ingalls-Burleigh loamy sands, 0 to 3 percent slopes; 1,700 feet west and 20 feet north of the southeastern corner of sec. 7, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 35 minutes 2 seconds N. and long. 85 degrees 19 minutes 4 seconds W.; Springfield Township:

Ap—0 to 9 inches; black (10YR 2/1) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

Cg—9 to 21 inches; light brownish gray (10YR 6/2) loamy sand; weak fine granular structure; very friable; common fine faint pale brown (10YR 6/3) masses of iron accumulation with diffuse boundaries along root channels and on faces of peds; neutral; clear wavy boundary.

2C—21 to 42 inches; stratified brown (7.5YR 5/4) sandy loam and silt loam; moderate fine platy structure parting to moderate medium subangular blocky; firm; strata of gray (5Y 6/1) silty clay loam; common medium distinct light brownish gray (10YR 6/2) masses of iron depletion and common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; neutral; abrupt smooth boundary.

2Cg—42 to 80 inches; stratified grayish brown (10YR 5/2) loamy sand, silty clay loam, and sandy loam; single grain and very friable in the loamy sand layers; massive and firm in the silty clay loam and sandy loam layers; few medium faint light brownish gray (10YR 6/2) masses of iron depletion with diffuse boundaries along root channels and on faces of peds; about 7 percent medium and fine gravel; slightly effervescent; slightly alkaline.

The content of fine gravel ranges from 0 to 5 percent throughout the profile. Depth of the 2Cg horizon ranges from 24 to 40 inches. Depth to free calcium carbonates ranges from 24 to 50 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly loamy sand but the range includes fine sand or sand or the mucky analogues of these textures.

The Cg horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is loamy sand or sand.

The 2C horizon has hue of 5Y to 7.5YR, value of 5 or 6, and chroma of 1 to 4. It is stratified silt loam, sandy loam, and silty clay loam.

The 3C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 4. It is stratified loamy sand, silt loam, and sand with strata of silty clay loam in some areas. The thickness and sequence of layers of the strata vary widely.

Croswell Series

The Croswell series consist of moderately well drained, rapidly permeable soils on outwash plains, kame moraines, remnant moraines, lake plains, and stream terraces. These soils formed in sandy material. Slope ranges from 0 to 3 percent. The soils are classified as sandy, mixed, frigid Oxyaquic Haplorthods.

Typical pedon of Croswell sand, 0 to 3 percent slopes; 150 feet north and 1,900 feet east of the southwestern corner of sec. 11, T. 27 N., R. 7 W.; USGS Kalkaska topographic quadrangle; lat. 44 degrees 44 minutes 33 seconds N. and long. 85 degrees 7 minutes 36 seconds W.; Kalkaska Township:

A—0 to 3 inches; black (N 2/0) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine, common medium, and few

coarse roots; strongly acid; abrupt smooth boundary.

E—3 to 8 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 7/2) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; about 2 percent fine gravel; very strongly acid; clear irregular boundary.

Bs1—8 to 12 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure; very friable; common medium and few fine and coarse roots between ortstein columns; columns of moderately cemented dark reddish brown (5YR 3/2) and strong brown (7.5YR 5/6) ortstein 3 to 6 inches wide extend through the Bs2 horizon; ortstein columns are 3 to 12 inches apart; ortstein occupies 30 percent of the horizon; about 2 percent fine gravel; strongly acid; clear irregular boundary.

Bs2—12 to 23 inches; strong brown (7.5YR 4/6) sand; single grain; loose; few fine and medium roots between ortstein columns; columns of weakly to strongly cemented dark reddish brown (5YR 3/2) and strong brown (7.5YR 5/6) ortstein 3 to 6 inches wide extend through the BC horizon; ortstein columns are 3 to 18 inches apart; ortstein occupies 30 percent of the horizon; about 3 percent fine gravel; moderately acid; clear wavy boundary.

BC—23 to 32 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/2) and strong brown (7.5YR 5/6) ortstein 2 to 8 inches wide extend through this horizon from the Bs2 horizon; ortstein columns are 3 to 18 inches apart; ortstein occupies 15 percent of the horizon; about 3 percent fine gravel; slightly acid; clear wavy boundary.

C1—32 to 55 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; few fine roots; many medium distinct strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries on faces of peds; about 2 percent fine gravel; neutral; gradual wavy boundary.

C2—55 to 80 inches; pale brown (10YR 6/3) sand; single grain; loose; about 3 percent fine gravel; neutral.

The content of fine gravel ranges from 0 to 14 percent throughout the profile. Depth to redoximorphic accumulations ranges from 28 to 40 inches. The content of ortstein ranges from 0 to 40 percent in the solum.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2. It is sand.

The Bs1 horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4. Value of 3 and chroma of 3 do not occur together. Texture is sand.

The Bs2 horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand.

The BC horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sand.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is sand.

Cublake Series

The Cublake series consist of moderately well drained, rapidly permeable soils on outwash plains, lake plains, and stream terraces. These soils formed in sandy deposits. Slope ranges from 0 to 3 percent. The soils are classified as sandy, mixed, frigid Oxyaquic Haplorthods.

Typical pedon of Cublake sand, 0 to 6 percent slopes; 1,300 feet south and 400 feet east of the northwestern corner of sec. 3, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 35 minutes 40 seconds N. and long. 85 degrees 16 minutes 14 seconds W.; Springfield Township:

A—0 to 4 inches; very dark gray (10YR 3/1) sand, brown (7.5YR 5/2) dry; weak fine granular structure; very friable; many fine roots; about 3 percent fine gravel; strongly acid; abrupt wavy boundary.

E—4 to 8 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; weak fine granular structure; very friable; few fine roots; about 3 percent fine gravel; moderately acid; clear irregular boundary.

Bs1—8 to 12 inches; brown (7.5YR 4/4) sand; weak medium granular structure; very friable; common fine roots; about 3 percent fine gravel; moderately acid; clear irregular boundary.

Bs2—12 to 31 inches; strong brown (7.5YR 4/6) sand; weak medium granular structure; very friable; few fine and medium roots; about 3 percent fine gravel; moderately acid; clear wavy boundary.

BC—31 to 49 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine roots; few fine distinct strong brown (7.5YR 5/8) masses of iron accumulation with sharp diffuse boundaries on faces of peds; about 3 percent fine gravel; slightly acid; clear wavy boundary.

C—49 to 56 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; few fine roots; many

medium distinct strong brown (7.5YR 5/6) masses of iron accumulation with sharp diffuse boundaries on faces of peds; about 2 percent fine gravel; slightly acid; gradual wavy boundary.

2C—56 to 80 inches; stratified gray (5Y 6/1) and olive brown (2.5Y 4/4) sandy clay loam; massive; firm; strata of brown (7.5YR 4/4) loamy sand; common medium distinct yellowish brown (10YR 5/8) masses of iron accumulation with sharp diffuse boundaries on faces of peds; about 1 percent fine gravel; slightly effervescent; slightly alkaline.

Depth to the 2C horizon ranges from 40 to 60 inches. The content of gravel ranges from 0 to 14 percent in the sandy upper part of the solum and from 0 to 3 percent in the 2C horizon. Ortstein makes up 0 to 30 percent of the upper part of the solum. Depth to redoximorphic accumulations ranges from 20 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2. It is sand.

The Bs1 horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 or 4. Value of 3 and chroma of 3 do not occur together. Texture is sand.

The Bs2 horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand.

The BC horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sand.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand.

The 2C horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 to 6. It is stratified sandy clay loam, silty clay loam, and loamy sand.

Dawson Series

The Dawson series consists of very poorly drained soils in depressions on kame moraines, lake plains, and outwash plains. Permeability is moderately slow to moderately rapid in the mucky material and rapid in the sandy underlying material. These soils formed in woody material that is 16 to 51 inches thick over sandy deposits. Slope ranges from 0 to 2 percent. The soils are classified as sandy or sandy-skeletal, mixed, dysic, frigid Terric Haplosaprists.

Typical pedon of Dawson mucky peat in an area of Dawson-Loxley peats; 2,100 feet east and 1,590 feet north of the southwestern corner of sec. 22, T. 26 N., R. 7 W.; USGS Kalkaska topographic quadrangle; lat. 44 degrees 37 minutes 51 seconds N. and long. 85 degrees 8 minutes 57 seconds W.; Orange Township:

Oe—0 to 4 inches; dark brown (7.5YR 3/2) broken face and rubbed mucky peat; about 90 percent fiber, 80 percent rubbed; weak medium granular structure; friable; many fine and medium roots; extremely acid; clear wavy boundary.

Oa1—4 to 14 inches; black (5YR 2/1) broken face and rubbed muck; about 10 percent fiber, 5 percent rubbed; weak medium granular structure; friable; few fine and medium roots; extremely acid; clear wavy boundary.

Oa2—14 to 20 inches; dark reddish brown (5YR 3/2) broken face and rubbed muck; about 15 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; extremely acid; abrupt wavy boundary.

A—20 to 22 inches; black (10YR 2/1) loam; massive; friable; about 1 percent fine gravel; very strongly acid; abrupt smooth boundary.

2C—22 to 80 inches; brown (10YR 4/3) sand; single grain; loose; common 1/8- to 1-inch-thick bands of very dark gray (10YR 3/1) organic matter; about 5 percent fine and medium gravel; strongly acid.

Thickness of the sapric material ranges from 16 to 51 inches. The content of woody fragments ranges from 0 to 5 percent in the Oa horizon. The content of fine and medium gravel ranges from 0 to 10 percent in the C horizon.

The Oe horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is dominantly mucky peat or peat.

The Oa horizon has hue of 5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is muck.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is loam, silt loam, or loamy sand.

The 2C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is sand.

Dighton Series

The Dighton series consists of well drained soils that formed in clayey over sandy or sandy-skeletal deposits on kame moraines and kames. Permeability is slow in the clayey material and rapid in the sandy material. Slope ranges from 12 to 50 percent. These soils are classified as clayey over sandy or sandy-skeletal, mixed, semiactive, frigid Haplic Glossudalfs.

Typical pedon of Dighton sandy loam in an area of Southwells-Mancelona-Dighton complex, 8 to 50 percent slopes, dissected; 200 feet east and 150 feet south of the northwestern corner of sec. 26, T. 25 N.,

R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 32 minutes 53 seconds N. and long. 85 degrees 14 minutes 48 second W.; Springfield Township:

A—0 to 4 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 6/1) dry; weak medium granular structure; friable; many fine, common medium, and few coarse roots; about 1 percent fine gravel; slightly acid; abrupt wavy boundary.

E—4 to 8 inches; brown (10YR 5/3) clay loam, light gray (10YR 7/1) dry; weak medium granular structure; friable; common fine and medium and few coarse roots; about 3 percent fine gravel; slightly acid; clear irregular boundary.

B/E—8 to 15 inches; reddish brown (5YR 4/3) clay (Bt part); Bt part occupies about 70 percent of the horizon and is completely surrounded by or penetrated by tongues of brown (10YR 5/3) clay loam (E part), light gray (10YR 7/1) dry; moderate medium subangular blocky structure in Bt part; weak medium granular structure in E part; firm; common fine and few medium and coarse roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; about 3 percent fine gravel; neutral; clear irregular boundary.

Bt—15 to 26 inches; reddish brown (5YR 4/3) clay; moderate medium subangular blocky structure; firm; common fine and medium roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; about 3 percent fine gravel; neutral; clear wavy boundary.

C—26 to 37 inches; brown (7.5YR 5/4) silty clay; moderate medium subangular blocky structure; firm; about 1 percent fine gravel; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2E´ and Bt—37 to 68 inches; yellowish brown (10YR 5/3) sand (E part); lamellae and bands of dark brown (7.5YR 4/4) loamy sand (Bt part); single grain in E part; weak medium granular structure in Bt part; loose in E part and very friable in Bt part; clay bridging between sand grains; few roots; slightly acid; abrupt wavy boundary.

2C—68 to 80 inches; light yellowish brown (10YR 6/4) stratified sand and gravelly sand; single grain; loose; about 16 percent fine gravel, 5 percent medium gravel, and 3 percent coarse gravel; strongly effervescent; moderately alkaline.

Depth to the base of the argillic horizon ranges from 20 to 45 inches. The clay content ranges from 35 to 60 percent. The content of gravel ranges from 1 to 5 percent in the clayey material and from 3 to 27 percent in the sandy substratum. The content of cobbles is 0 to 1 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly sandy loam but the range includes loam.

The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. It is clay loam or sandy loam. The horizon can have fragipan-like characteristics, such as hardness and brittleness when dry.

The B part of the B/E horizon and the Bt horizon have hue of 7.5YR or 5YR and value and chroma of 3 or 4. They are clay, silty clay loam, or clay loam. The E part of the B/E horizon has colors and textures similar to those of the E horizon.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay or silty clay loam.

The E part of the 2E´ and Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is sand. The Bt part of this horizon occurs as lamellae 1/4 inch to 3 inches thick. It has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand or sandy loam.

The 2C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is stratified sand and gravelly sand.

East Lake Series

The East Lake series consists of somewhat excessively drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy and gravelly deposits. Slope ranges from 0 to 6 percent. The soils are classified as sandy, mixed, frigid Entic Haplorthods.

Typical pedon of East Lake sand, 0 to 6 percent slopes; 900 feet east and 600 feet north of the southwestern corner of sec. 26, T. 25 N., R. 8 W.; USGS Smithville topographic quadrangle; lat. 44 degrees 31 minutes 50 seconds N. and long. 85 degrees 14 minutes 59 seconds W.; Springfield Township:

Oe—0 to 1 inch; black (N 2/0) partially decomposed forest litter.

E—1 to 3 inches; dark grayish brown (10YR 4/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; about 5 percent fine and medium gravel; strongly acid; clear irregular boundary.

Bs1—3 to 15 inches; dark brown (7.5YR 3/4) loamy

sand; weak fine granular structure; very friable; common fine and medium and few coarse roots; about 7 percent fine and medium gravel and about 1 percent coarse gravel; moderately acid; clear wavy boundary.

Bs2—15 to 26 inches; strong brown (7.5YR 4/6) sand; single grain; loose; common fine and few medium roots; about 5 percent fine and medium gravel; neutral; abrupt irregular boundary.

2Bt—26 to 28 inches; very dark gray (10YR 3/1) very gravelly loamy sand; weak fine granular structure; very friable; clay bridging between sand grains; many fine and common medium roots; about 60 percent fine and medium gravel; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2C—28 to 80 inches; light yellowish brown (10YR 6/4) stratified sand and gravel; single grain; loose; about 31 percent fine and medium gravel; strongly effervescent; moderately alkaline.

Depth to free calcium carbonates ranges from 20 to 40 inches. The content of fine and medium gravel ranges from 1 to 20 percent in the solum and from 10 to 34 percent in the substratum. Individual strata of gravel make up as much as 55 percent of the profile. The content of cobbles ranges from 0 to 10 percent throughout the profile. The thickness of the 2Bt horizon ranges from 0 to 2 inches. The clay content of the 2Bt horizon ranges from 2 to 10 percent. The 2Bt horizon is a non-argillic beta-B horizon.

The O horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is muck.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is sand.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. It is sand.

The Bs2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 5 or 6. It is sand.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 to 4. It is very gravelly loamy sand, gravelly sand, or gravelly sandy loam.

The 2C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is stratified gravelly sand and sand.

Finch Series

The Finch series consists of somewhat poorly drained soils on outwash plains and lake plains. These soils formed in sandy deposits. Permeability is moderately rapid in the ortstein and rapid in the rest of pedon. Slope ranges from 0 to 3 percent. The soils are classified as sandy, mixed, frigid, ortstein Typic Duraquods.

Typical pedon of Finch sand, 0 to 3 percent slopes; 2,500 feet west and 120 feet south of the northeastern corner of sec. 28, T. 28 N., R. 5 W.; USGS Starvation Lake topographic quadrangle; lat. 44 degrees 47 minutes 37 seconds N. and long. 84 degrees 55 minutes 57 seconds W.; Blue Lake Township:

Oe—0 to 2 inches; black (5YR 2/1) partially decomposed forest litter.

E—2 to 11 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; single grain; loose; common fine, medium, and coarse roots; common fine and medium faint light brownish gray (10YR 6/2) masses of iron depletion with clear boundaries along root channels and on faces of peds; very strongly acid; clear wavy boundary.

Bhsm—11 to 17 inches; dark reddish brown (5YR 3/2) and yellowish red (5YR 4/6) sand; massive; very hard; few fine roots in the E material extend into this horizon; ortstein occupies 100 percent of the horizon and is strongly cemented; ortstein occurs as a horizontally continuous layer with tongues 2 to 4 inches wide that extend to a depth of 29 inches; many coarse distinct strong brown (7.5YR 4/6) masses of iron accumulation with clear boundaries throughout; strongly acid; clear irregular boundary.

BC—17 to 27 inches; light yellowish brown (10YR 6/4) and strong brown (7.5YR 4/6) sand; massive; ortstein occupies 80 percent of the horizon and is strongly cemented; ortstein occurs as a horizontally continuous layer with tongues 2 to 3 inches wide that extend to a depth of 9 inches; common fine distinct light brownish gray (10YR 6/2) masses of iron depletion and few medium distinct strong brown (7.5YR 5/8) masses of iron accumulation with clear boundaries throughout; strongly acid; abrupt wavy boundary.

C1—27 to 42 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; ortstein occupies 10 percent of the horizon and is weakly cemented; strong brown (7.5YR 4/6) ortstein occurs as tongues 2 to 3 inches wide that extend from the Bhsm horizon; many fine faint light brownish gray (10YR 6/2) masses of iron depletion and few medium distinct brownish yellow (10YR 6/6) masses of iron accumulation with clear boundaries throughout; strongly acid; clear wavy boundary.

C2—42 to 80 inches; pale brown (10YR 6/3) sand; single grain; loose; strongly acid.

The content of fine gravel ranges from 0 to 5 percent throughout the profile. Depth to redoximorphic depletions and accumulations ranges from 6 to 20 inches. The content of ortstein in the subsoil ranges from 50 to 100 percent.

Some pedons have an A horizon. This horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is sand or mucky sand.

The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. It is sand.

The Bhsm horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is sand.

The BC horizon has hue of 5YR to 10YR, value of 3 to 6, and chroma of 4 to 6. It is sand.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 4. It is sand.

Gauld Series

The Gauld series consists of poorly drained, moderately permeable soils on lake plains. These soils formed in loamy glaciolacustrine deposits. Slope ranges from 0 to 2 percent. The soils are classified as coarse-loamy, mixed, semiactive, frigid Typic Endoaquolls.

Typical pedon of Gauld fine sandy loam; 1,250 feet south and 185 feet east of the northwestern corner of sec. 32, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 31 minutes 22 seconds N. and long. 85 degrees 17 minutes 50 seconds W.; Springfield Township:

A—0 to 9 inches; black (N 2/0) fine sandy loam, gray (10YR 5/1) dry; weak medium granular structure; friable; many fine and common medium and coarse roots; slightly acid; abrupt wavy boundary.

Bw—9 to 15 inches; brown (10YR 5/3) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; common very dark gray (10YR 3/1) organic stains in root channels and in pores; common distinct prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and many fine faint gray (2.5Y 6/1) masses of iron depletion with sharp boundaries along root channels and on faces of peds; neutral; clear wavy boundary.

Bg—15 to 22 inches; gray (2.5Y 5/1) fine sandy loam; weak coarse subangular blocky structure; friable; few fine roots; many coarse prominent dark yellowish brown (10YR 4/6) masses of iron accumulation with sharp boundaries and many fine faint gray (2.5Y 6/1) masses of iron depletion with diffuse boundaries on faces of peds; neutral; clear wavy boundary.

Cg1—22 to 38 inches; dark gray (2.5Y 4/1) stratified sandy loam that has thin layers of sand, silt, and silt loam; massive; friable; many medium fine light brownish gray (10YR 6/2) masses of iron depletion on faces of peds; slightly effervescent; slightly alkaline; abrupt wavy boundary.

Cg2—38 to 80 inches; stratified grayish brown (10YR 5/2) sand and brown (10YR 5/3) sandy loam; single grain; loose; about 7 percent fine gravel; moderately effervescent; slightly alkaline.

Depth to free carbonates ranges from 20 to 30 inches. The content of gravel ranges from 0 to 5 percent in the solum and from 3 to 14 percent in the substratum.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly fine sandy loam but the range includes silt loam, loamy fine sand, and the mucky analogues of these textures.

The B horizon has hue of 2.5Y to 10YR, value of 4 to 6, and chroma of 1 to 3. It is fine sandy loam, silt loam, sandy clay loam, or very fine sandy loam. Thin strata of fine sand or loamy sand occur in some pedons.

The Cg horizon has hue of 5Y, 2.5Y, or 10YR, value of 3 to 6, and chroma of 1 or 2. It is stratified sandy loam, sand, silt loam, and silt.

The 2C horizon, if it occurs, has hue of 5Y or 10YR, value of 4 or 6, and chroma of 1 to 4. It is sand. Strata of silt loam, silty clay loam, or sandy loam occur in some pedons.

Gladwin Series

The Gladwin series consists of somewhat poorly drained soils in valley trains. These soils formed in sandy deposits. Permeability is moderately rapid in the upper sandy material and very rapid in the underlying material. Slope ranges from 0 to 3 percent. The soils are classified as sandy, mixed, frigid Alfic Haplaquods.

Typical pedon of Gladwin loamy sand, 0 to 3 percent slopes; 450 feet south and 2,420 feet west of the northeastern corner of sec. 15, T. 28 N., R. 8 W.; USGS Torch River topographic quadrangle; lat. 44 degrees 49 minutes 41 seconds N. and long. 85 degrees 15 minutes 44 seconds W.; Clearwater Township:

A—0 to 5 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; many fine and few medium and

coarse roots; moderately acid; abrupt wavy boundary.

E—5 to 13 inches; brown (10YR 5/3) loamy sand, light gray (10YR 7/1) dry; weak medium subangular blocky structure; very friable; common fine and few medium and coarse roots; black (10YR 2/1) organic stains along root channels and pores; about 3 percent fine gravel; moderately acid; clear irregular boundary.

Bs—13 to 17 inches; brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few fine and medium roots; few medium distinct strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; about 3 percent fine gravel; moderately acid; clear wavy boundary.

Bt1—17 to 28 inches; brown (7.5YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine roots; few fine prominent light brownish gray (10YR 6/2) masses of iron depletion and common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; about 5 percent fine and medium gravel; neutral; abrupt wavy boundary.

Bt2—28 to 32 inches; brown (7.5YR 4/3) gravelly sandy loam; weak medium subangular blocky structure; friable; few fine roots; few fine prominent light brownish gray (10YR 6/2) masses of iron depletion and common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; about 15 percent fine and medium gravel and 5 percent coarse gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.

2C—32 to 80 inches; brown (10YR 5/3) stratified very gravelly loamy sand and sand; weak medium granular structure; very friable; common strata of grayish brown (2.5Y 5/2) sandy clay loam and silt loam more than 1 inch thick; few fine prominent light brownish gray (10YR 6/2) masses of iron depletion and common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation with diffuse boundaries along faces of peds; about 25 percent fine and medium gravel and 10 percent coarse gravel; strongly effervescent; strongly alkaline.

Depth to the 2C horizon and free calcium carbonates ranges from 20 to 40 inches. In the solum, the content of gravel ranges from 0 to 25 percent and the content of cobbles ranges from 0 to 5 percent. In the substratum, the content of gravel ranges from 10 to 45 percent and the content of cobbles ranges from 0 to 10 percent.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly loamy sand but the range includes sand.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is loamy sand or sand.

The Bs horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. It is loamy sand or sand.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam or gravelly sandy loam.

The 2C horizon has hue of 10YR, value of 5 to 7, and chroma of 2 to 4. It is stratified very gravelly loamy sand, sand, and loamy sand with strata of silt loam and sandy clay loam. Individual strata are 1 inch to 10 inches thick.

Graycalm Series

The Graycalm series consists of somewhat excessively drained, rapidly permeable soils on kame moraines, stream terraces, remnant moraines, and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 45 percent. The soils are classified as mixed, frigid Lamellic Udipsamments.

Typical pedon of Graycalm sand in an area of Graycalm-Klacking complex, 0 to 6 percent slopes (fig. 15); 1,200 feet north and 10 feet east of the southwestern corner of sec. 13, T. 25 N., R. 5 W.; USGS Cote Dame Marie topographic quadrangle; lat. 44 degrees 30 minutes 53 seconds N. and long. 84 degrees 52 minutes 12 seconds W.; Garfield Township:

A—0 to 3 inches; black (10YR 2/1) sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and common coarse and medium roots; very strongly acid; abrupt wavy boundary.

Bw1—3 to 9 inches; dark yellowish brown (10YR 4/6) sand; weak fine subangular blocky structure; very friable; common fine and few medium and coarse roots; about 1 percent fine gravel; strongly acid; clear irregular boundary.

Bw2—9 to 19 inches; dark yellowish brown (10YR 4/6) sand; weak medium subangular blocky structure; very friable; few fine and coarse roots; about 1 percent fine gravel; moderately acid; clear wavy boundary.

E—19 to 31 inches; very pale brown (10YR 7/4) sand, pale yellow (2.5Y 7/4) dry; single grain; loose; few fine roots; about 1 percent fine gravel; moderately acid; abrupt irregular boundary.

E and Bt—31 to 80 inches; very pale brown (10YR 7/4) sand (E part), pale yellow (2.5Y 7/4) dry; thin

discontinous yellowish brown (10YR 5/4) loamy sand lamellae (Bt part); single grain in E part; weak fine granular structure in Bt part; loose in E part and very friable in Bt part; clay bridging between sand grains; lamellae are 1/8 inch to 3 inches thick and accumulation of lamellae is less than 6 inches thick; about 3 percent fine gravel; strongly acid.

The content of fine gravel ranges from 0 to 14 percent and the content of cobbles ranges from 0 to 5 percent throughout the profile. The clay content in the E and Bt horizon ranges from 0 to 10 percent. Depth to the first lamellae ranges from 25 to 45 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3, or it is neutral in hue and has value of 2 to 4. It is sand or loamy sand.

The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is sand or loamy sand.

The E horizon below the Bw horizon and the E part of the E and Bt horizon have hue of 10YR, value of 5 to 7, and chroma of 4 or 5. Texture is sand or loamy sand.

The B part of the E and Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand or sandy loam. Lamellae range from 1/8 inch to 3 inches in thickness, and accumulation of lamellae is less than 6 inches thick.

Some pedons have a C horizon.

Grayling Series

The Grayling series consists of excessively drained, rapidly permeable soils on outwash plains, stream terraces, kame moraines, and remnant moraines. These soils formed in sandy deposits. Slope ranges from 0 to 45 percent. The soils are classified as mixed, frigid Typic Udipsamments.

Typical pedon of Grayling sand, 0 to 6 percent slopes; 400 feet west and 2,400 feet south of the northeastern corner of sec. 1, T. 25 N., R. 6 W.; USGS Flecther topographic quadrangle; lat. 44 degrees 35 minutes 31 seconds N. and long. 85 degrees 58 minutes 23 seconds W.; Garfield Township:

Oe—0 to 1 inch; black (10YR 2/1) partially decomposed forest litter.

A—1 to 3 inches; very dark gray (10YR 3/1) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; about 1 percent fine gravel; very strongly acid; abrupt smooth boundary.

Bw1—3 to 15 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure; very friable; common fine and few medium and coarse roots; about 3 percent fine gravel; strongly acid; clear wavy boundary.

Bw2—15 to 24 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine and medium roots; about 3 percent fine gravel; moderately acid; clear wavy boundary.

BC—24 to 30 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 3 percent fine gravel; moderately acid; gradual wavy boundary.

C—30 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 3 percent fine gravel; slightly acid.

The content of fine gravel ranges from 0 to 7 percent throughout the profile. The control section consists of 5 to 20 percent fine sand.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is sand.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand.

The BC horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 6 to 8. It is sand.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 4 to 6. It is sand.

Halfaday Series

The Halfaday series consist of moderately well drained, rapidly permeable soils on outwash plains, kame moraines, lake plains, and stream terraces. These soils formed in sandy deposits. Slope ranges from 0 to 4 percent. The soils are classified as sandy, mixed, frigid Oxyaquic Haplorthods.

Typical pedon of Halfaday loamy sand, 0 to 4 percent slopes; 1,600 feet south and 275 feet west of the northeastern corner of sec. 28, T. 27 N., R. 6 W.; USGS Sigma topographic quadrangle; lat. 44 degrees 23 minutes 31 seconds N. and long. 85 degrees 53 minutes 42 seconds W.; Excelsior Township:

A—0 to 1 inch; very dark gray (10YR 3/1) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine and medium and few coarse roots; very strongly acid; abrupt smooth boundary.

E—1 to 4 inches; grayish brown (10YR 5/2) loamy sand, light gray (10YR 7/2) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; common fine, medium, and coarse roots; about 3 percent fine gravel; very strongly acid; clear irregular boundary.

Bhs—4 to 6 inches; dark reddish brown (5YR 3/2) loamy sand; weak medium subangular blocky

structure parting to weak fine granular; friable; common fine and medium and few coarse roots; about 15 percent of the horizon extends as tongues to a depth of 18 inches; about 3 percent fine gravel; very strongly acid; clear irregular boundary.

Bs1—6 to 11 inches; dark brown (7.5YR 3/4) loamy sand; weak medium granular structure; very friable; common medium and few fine and coarse roots; about 3 percent fine gravel; strongly acid; clear wavy boundary.

Bs2—11 to 24 inches; strong brown (7.5YR 4/6) sand; weak fine subangular blocky structure; very friable; few fine and coarse roots; about 3 percent fine gravel; strongly acid; clear wavy boundary.

BC—24 to 35 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine roots; 30 percent of the horizon is occupied by horizontal dark reddish brown (5YR 3/3) weakly cemented ortstein; many coarse distinct strong brown (7.5YR 5/8) masses of iron accumulation and few fine prominent light brownish gray (10YR 6/2) masses of iron depletion with sharp boundaries on faces of peds; about 3 percent fine gravel; strongly acid; clear wavy boundary.

C1—35 to 45 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 20 percent of the horizon is occupied by horizontal brown (7.5YR 4/4) weakly cemented ortstein; many coarse distinct strong brown (7.5YR 5/8) masses of iron accumulation and few fine prominent light brownish gray (10YR 6/2) masses of iron depletion with sharp boundaries on faces of peds; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

C2—45 to 80 inches; pale brown (10YR 6/3) sand; single grain; loose; about 3 percent fine gravel; neutral.

Depth to redoximorphic accumulations and depletions ranges from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent throughout the profile. The content of ortstein ranges from 0 to 35 percent in the solum.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is dominantly loamy sand or sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is loamy sand or sand.

The Bhs horizon has hue of 7.5YR or 5YR and value and chroma of 2 or 3. It is loamy sand or sand.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. It is loamy sand or sand.

The Bs2 horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand.

The BC horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sand.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is sand.

Histosols

Histosols consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on kame moraines, lake plains, and outwash plains. These soils formed in woody and herbaceous material that is more than 51 inches thick. Slope ranges from 0 to 2 percent.

Typical pedon of Histosols in an area of Histosols and Aquents, ponded; 2,560 feet south and 10 feet east of the northwestern corner of sec. 29, T. 26 N., R. 6 W.; USGS Sharon topographic quadrangle; lat. 44 degrees 37 minutes 10 seconds N. and long. 85 degrees 4 minutes 53 seconds W.; Garfield Township:

Oa1—0 to 14 inches; black (5YR 2/1) broken face and rubbed muck; about 15 percent fiber, less than 5 percent rubbed; weak coarse granular structure; friable; many fine and common medium roots; about 10 percent woody fragments; neutral; abrupt wavy boundary.

Oa2—14 to 80 inches; black (N 2/0) broken face and rubbed muck; about 3 percent fiber, less than 1 percent rubbed; weak coarse platy structure; few fine roots; friable; neutral.

The thickness of the sapric material ranges from 16 to more than 51 inches. The content of woody fragments ranges from 0 to 15 percent.

The Oa horizon has hue of 5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Some pedons have an Oe horizon. This horizon is muck.

Hodenpyl Series

The Hodenpyl series consist of well drained, moderately rapidly permeable soils on outwash plains and kame moraines. These soils formed in loamy over sandy deposits. Slope ranges from 0 to 6 percent. The soils are classified as coarse-loamy, mixed, active, frigid Haplic Glossudalfs.

Typical pedon of Hodenpyl sandy loam in an area of Hodenpyl-Montcalm complex, 0 to 6 percent slopes; 1,900 feet north and 150 feet east of the southwestern corner of sec. 20, T. 25 N., R. 5 W.; USGS Fletcher topographic quadrangle; lat. 44 degrees 32 minutes 40

seconds N. and long. 84 degrees 57 minutes 4 seconds W.; Garfield Township:

Ap—0 to 5 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 6/1) dry; weak medium granular structure; friable; many fine and medium roots; about 1 percent fine gravel; moderately acid; abrupt smooth boundary.

E—5 to 14 inches; brown (10YR 5/3) sandy loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure; friable; few fine roots; about 1 percent fine gravel; slightly acid; clear irregular boundary.

E/B—14 to 20 inches; brown (10YR 5/3) sandy loam (E part), light gray (10YR 7/2) dry; E part occupies 70 percent of the horizon and is surrounded by remnants of brown (7.5YR 4/4) loam (Bt part); moderate medium subangular blocky structure; friable; few fine roots; many fine discontinous tubular pores; colloidal clay in bridges between sand grains; about 1 percent fine gravel; slightly acid; gradual diffuse boundary.

B/E—20 to 34 inches; brown (7.5YR 4/4) sandy loam (Bt part); Bt part occupies 80 percent of the horizon and is surrounded by remnants of brown (10YR 5/3) sandy loam (E part), light gray (10YR 7/2) dry; moderate medium subangular blocky structure; firm; many fine discontinous tubular pores; colloidal clay in bridges between sand grains; about 1 percent fine gravel; slightly acid; abrupt wavy boundary.

E and Bt—34 to 80 inches; pale brown (10YR 6/3) sand (E part), light yellowish brown (10YR 6/4) dry; lamellae of strong brown (7.5YR 4/6) loamy sand (Bt part); lamellae are 1/8 inch to 3 inches thick; single grain in E part; weak fine granular structure in Bt part; loose in E part and very friable in Bt part; clay bridging between sand grains; about 3 percent fine gravel; neutral.

The content of gravel ranges from 0 to 3 percent in the upper part of the solum and from 0 to 14 percent in the E and Bt horizon. Depth to the sandy E and Bt horizon ranges from 20 to 45 inches. The clay content ranges from 8 to 18 percent in the B/E horizon. Lamellae of the E and Bt horizon are 1/8 inch to 4 inches thick.

The Ap or A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly sandy loam but the range includes fine sandy loam.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam or fine sandy loam.

The E part of the E/B and B/E horizons has colors and textures similar to those of the E horizon. The B part of the E/B and B/E horizons has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam, loam, or fine sandy loam.

The E part of the E and Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is sand. The Bt part of this horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand or sandy loam.

Ingalls Series

The Ingalls series consists of somewhat poorly drained soils on lake plains. These soils formed in sandy deposits over stratified loamy glaciolacustrine deposits. Permeability is rapid in the upper sandy material and moderately slow in the loamy underlying material. Slope ranges from 0 to 3 percent. The soils are classified as sandy over loamy, mixed, active, frigid Typic Endoaquods.

Typical pedon of Ingalls loamy sand in an area of Ingalls-Burleigh loamy sands, 0 to 3 percent slopes; 1,900 feet west and 50 feet south of the northeastern corner of sec. 18, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 34 minutes 8 seconds N. and long. 85 degrees 19 minutes 12 seconds W.; Springfield Township:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loamy sand, brown (7.5YR 5/2) dry; weak medium granular structure; very friable; about 3 percent fine gravel; slightly acid; abrupt smooth boundary.

E—7 to 8 inches; dark grayish brown (10YR 4/2) loamy sand, light gray (10YR 7/1) dry; weak medium granular structure; very friable; very dark gray (10YR 3/1) organic stains along root channels and pores; about 3 percent fine gravel; moderately acid; abrupt broken boundary.

Bhs—8 to 13 inches; dark reddish brown (5YR 2.5/2) loamy sand; moderate medium granular structure; very friable; common fine distinct strong brown (7.5YR 5/8) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; about 30 percent of the horizon is occupied by weakly cemented dark reddish brown (5YR 3/2) ortstein; about 3 percent fine gravel; moderately acid; clear irregular boundary.

Bs—13 to 18 inches; brown (7.5YR 4/4) sand; weak fine granular structure; very friable; common fine distinct strong brown (7.5YR 5/8) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; about 3 percent fine gravel; slightly acid; clear wavy boundary.

BC—18 to 26 inches; yellowish brown (10YR 5/4) sand; weak fine subangular blocky structure; very

friable; common medium faint pale brown (10YR 6/3) masses of iron accumulation with diffuse boundaries along faces of peds; about 3 percent fine gravel; neutral; abrupt wavy boundary.

2C—26 to 80 inches; brown (10YR 5/3) loamy sand; weak fine granular structure; very friable; strata of reddish brown (5YR 5/3) silty clay loam; strata are massive and firm; many coarse distinct yellowish brown (10YR 5/6 and 5/8) and many coarse prominent olive brown (2.5Y 4/4) masses of iron accumulation and many coarse prominent greenish gray (5GY 6/1) masses of iron depletion with sharp boundaries along faces of peds; many light gray (10YR 7/1) masses of calcium carbonate occur with the silty clay loam strata; about 1 percent fine gravel; slightly effervescent; slightly alkaline.

Depth to the 2C horizon and free calcium carbonates ranges from 20 to 40 inches. The content of gravel ranges from 0 to 5 percent throughout the profile. The content of cobbles ranges from 0 to 8 percent in the upper sandy part of the profile.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Texture is dominantly loamy sand but the range includes sand and fine sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2. It is loamy sand or sand.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is loamy sand, fine sand, or sand.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 3 to 5. Value of 3 and chroma of 3 do not occur together. Texture is sand or fine sand.

The BC horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. It is sand or loamy sand.

The 2C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 to 4. It is loamy sand with strata of silt loam, silty clay loam, loamy fine sand, or fine sandy loam. Thickness of individual strata ranges from less than 1 inch to 18 inches.

Islandlake Series

The Islandlake series consist of somewhat excessively drained, rapidly permeable soils on kame moraines, kames, remnant moraines, outwash plains, and stream terraces. These soils formed in sandy deposits. Slope ranges from 0 to 35 percent. The soils are classified as sandy, mixed, frigid Lamellic Haplorthods.

Typical pedon of Islandlake sand, 0 to 6 percent slopes (fig. 16); 1,250 feet north and 800 feet east of the southwestern corner of sec. 13, T. 27 N., R. 5 W.; USGS Lake Margrethe topographic quadrangle; lat. 44 degrees 43 minutes 56 seconds N. and long. 84 degrees 51 minutes 56 seconds W.; Bear Lake Township:

Oe—0 to 1 inch; dark brown (7.5YR 3/2) partially decomposed leaf litter.

A—1 to 2 inches; very dark gray (10YR 3/1) sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; about 3 percent fine gravel; very strongly acid; abrupt wavy boundary.

E—2 to 5 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 7/2) dry; weak medium granular structure; very friable; common fine and medium and few coarse roots; about 3 percent fine gravel; strongly acid; clear irregular boundary.

Bhs—5 to 6 inches; dark reddish brown (5YR 3/3) loamy sand; moderate fine subangular blocky structure; very friable; common fine and medium and few coarse roots; about 3 percent fine gravel; strongly acid; clear broken boundary.

Bs1—6 to 19 inches; brown (7.5YR 4/4) sand; weak fine subangular blocky structure; very friable; common fine and medium and few coarse roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/2) and dark brown (7.5YR 3/4) ortstein 4 to 5 inches wide extend into the Bs2 horizon; ortstein columns are 5 to 20 inches apart; ortstein occupies 13 percent of the horizon; about 5 percent fine gravel; strongly acid; clear wavy boundary.

Bs2—19 to 27 inches; strong brown (7.5YR 4/6) sand; weak fine subangular blocky structure; very friable; common fine and few medium roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/2) and dark brown (7.5YR 3/4) ortstein 4 to 5 inches wide extend through this horizon from the Bs1 horizon and into the E´ horizon; ortstein columns are 5 to 20 inches apart; ortstein occupies 13 percent of the horizon; about 5 percent fine gravel; strongly acid; clear irregular boundary.

E´—27 to 52 inches; yellowish brown (10YR 5/4) sand, very pale brown (10YR 7/4) dry; weak fine granular structure; very friable; few fine and medium roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 3/2) and dark brown (7.5YR 3/4) ortstein about 3 inches wide extend into this horizon from the Bs2 horizon; ortstein columns are 3 to more than 40 inches apart; ortstein occupies 7 percent of the horizon; about 7 percent fine gravel; moderately acid; abrupt broken boundary.

E´ and Bt—52 to 80 inches; light yellowish brown

Figure 13.—Profile of Allendale sand. Allendale soils have a clayey subsoil and a substratum at a depth of 24 inches. Depth is marked in inches.

Figure 14.—Profile of Blue Lake loamy sand. Lamellae occur in bands that are 1/8 to 1 inch thick. Depth is marked in inches.

Figure 15.—Profile of Graycalm sand. Lamellae occur at a depth of 36 inches or more. Depth is marked in inches.

Figure 16.—Profile of Islandlake sand. Lamellae occur at a depth of 28 inches. Depth is marked in inches.

Figure 17.—Profile of Kalkaska sand. An accumulation of organic carbon, which improves root development and site index, is at a depth of 7 inches and has an irregular boundary. Depth is marked in feet.

Figure 18.—Profile of Kellogg sand. This Kellogg soil has a clayey subsoil and substratum at a depth of 28 inches. Depth is marked in inches.

Figure 19.—Profile of Southwells loamy sand. An accumulation of clay occurs as lamellae and a horizon. Depth is marked in feet.

Figure 20.—Profile of Wakeley muck. A clayey substratum is at a depth of 28 inches. Depth is marked in inches.

(10YR 6/4) sand (E´ part), very pale brown (10YR 7/4) dry; brown (7.5YR 4/4) loamy sand lamellae (Bt part); weak fine granular structure in E´ part; medium thick platy structure in Bt part; very friable in E´ part and friable in Bt part; lamellae are 1/8 to 1/4 inch thick and total accumulation of lamellae is less than 6 inches; few fine roots; about 7 percent fine gravel; moderately acid.

The content of fine gravel ranges from 0 to 14 percent throughout the profile. The content of cobbles ranges from 0 to 3 percent throughout the profile. Depth to lamellae ranges from 37 to 60 inches. The content of ortstein ranges from 0 to 35 percent in the Bs and E´ horizon.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is sand or loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 3. It is sand or loamy sand.

The Bhs horizon has hue of 5YR, value of 2 or 3, and chroma of 1 to 3. It is loamy sand or sand.

The Bs1 horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. Value of 2 or 3 and chroma of 2 or 3 do not occur together. Texture is sand or loamy sand.

The Bs2 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 8. It is sand.

The E´ horizon and the E part of the E´ and Bt horizon have hue of 10YR, value of 5 or 6, and chroma of 2 to 4. Texture is sand.

The Bt part of the E´ and Bt horizon consists of lamellae 1/8 inch to 2 inches thick. The total accumulation of lamellae within a depth of 80 inches is less than 6 inches.

The Bt horizon, if it occurs, has hue of 10YR to 5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand or sand.

Kalkaska Series

The Kalkaska series consists of somewhat excessively drained, rapidly permeable soils on kame moraines, beach ridges, stream terraces, remnant moraines, and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 35 percent. The soils are classified as sandy, mixed, frigid Typic Haplorthods.

Typical pedon of Kalkaska sand, 0 to 6 percent slopes (fig. 17); 1,900 feet north and 100 feet east of the southwestern corner of sec. 13, T. 28 N., R. 7 W.; USGS Westwood topographic quadrangle; lat. 44 degrees 49 minutes 13 seconds N. and long. 85 degrees 6 minutes 35 seconds W.; Rapid River Township:

Oi—1 inch to 0; undecomposed forest litter.

A—0 to 1 inch; black (7.5YR 2.5/1) sand, black (10YR 2/1) dry; weak fine granular structure; very friable; many fine and few medium and coarse roots; about 5 percent fine gravel; strongly acid; abrupt smooth boundary.

E—1 to 4 inches; brown (7.5YR 5/2) sand, gray (10YR 6/1) dry; weak fine granular structure; very friable; common fine and few medium and coarse roots; about 5 percent fine gravel; strongly acid; clear irregular boundary.

Bhs—4 to 6 inches; dark reddish brown (5YR 3/3) sand; weak fine granular structure; very friable; common fine and few medium and coarse roots; about 5 percent fine gravel; moderately acid; clear broken boundary.

Bs1—6 to 21 inches; dark brown (7.5YR 3/4) sand; weak fine granular structure; very friable; few fine and medium roots; about 5 percent fine gravel; moderately acid; clear wavy boundary.

Bs2—21 to 35 inches; strong brown (7.5YR 4/6) sand; weak fine granular structure; very friable; few fine roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 2.5/2) ortstein 3 to 5 inches wide extend through this horizon and into the BC horizon; ortstein columns are 19 to 24 inches apart; ortstein occupies 7 percent of the horizon; about 5 percent fine gravel; slightly acid; gradual wavy boundary.

BC—35 to 50 inches; yellowish brown (10YR 5/6) sand; weak fine granular structure; very friable; few fine roots between ortstein columns; columns of weakly cemented dark reddish brown (5YR 2.5/2) ortstein 3 to 5 inches wide extend into this horizon from the Bs2 horizon; ortstein columns are 19 to more than 40 inches apart; ortstein occupies 7 percent of the horizon; about 5 percent fine gravel; slightly acid; gradual wavy boundary.

C—50 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 5 percent fine gravel; slightly acid.

The content of fine gravel ranges from 0 to 10 percent and the content of cobbles ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3.

Some pedons have an Ap horizon. This horizon has hue of 10YR to 5YR, value of 2 or 3, and chroma of 1 or 2. It is sand or loamy sand.

The E horizon has hue of 5YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. It is sand or loamy sand.

The Bhs horizon has hue of 5YR, value of 2 or 3, and chroma of 1 to 3. It is sand or loamy sand.

The Bs horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. The content of ortstein ranges from 0 to 30 percent. The horizon is sand.

The BC horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. It is sand.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 3 to 6. It is sand.

Kellogg Series

The Kellogg series consists of moderately well drained soils on lake plains. These soils formed in sandy deposits overlying clayey glaciolacustrine deposits. Permeability is rapid in the sandy material and slow in the clayey underlying material. Slope ranges from 0 to 6 percent. The soils are classified as sandy over clayey, mixed, active, frigid Alfic Oxyaquic Haplorthods.

Typical pedon of Kellogg sand, 0 to 6 percent slopes (fig. 18); 1,200 feet north and 700 feet east of the southwestern corner of sec. 23, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 32 minutes 33 seconds N. and long. 85 degrees 15 minutes 12 seconds W.; Springfield Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; about 5 percent fine gravel; moderately acid; abrupt smooth boundary.

Bs1—9 to 17 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; common fine and few medium roots; about 5 percent fine gravel; moderately acid; clear wavy boundary.

Bs2—17 to 22 inches; brown (7.5YR 5/4) sand; weak fine subangular blocky structure; very friable; common fine and medium roots; about 5 percent fine gravel; moderately acid; clear wavy boundary.

Bs3—22 to 32 inches; strong brown (7.5YR 5/6) sand; weak fine granular structure; very friable; few fine roots; few medium distinct strong brown (7.5YR 5/8) masses of iron accumulation with sharp boundaries along root channels and on faces of peds in the lower part of the horizon; about 5 percent fine gravel; moderately acid; abrupt wavy boundary.

2B/E—32 to 40 inches; brown (7.5YR 4/4) silty clay loam (Bt part); Bt part occupies 75 percent of the horizon and is surrounded by thick coatings of pale brown (10YR 6/3) loamy sand (E part), light gray (10YR 7/2) dry; moderate medium subangular blocky structure; firm; few fine roots; few thin brown (10YR 4/3) clay films on faces of peds; common medium distinct yellowish brown (10YR 5/8) masses of iron accumulation with sharp boundaries along faces of peds; about 2 percent fine gravel; neutral; clear irregular boundary.

2Bt—40 to 60 inches; brown (7.5YR 4/4) silty clay loam (Bt part); Bt part occupies 90 percent of the horizon and is surrounded by thick coatings of pale brown (10YR 6/3) silt loam (E part), light gray (10YR 7/2) dry; moderate coarse subangular blocky structure; firm; thin lenses of dark yellowish brown (10YR 4/4) silt loam; few thin brown (10YR 4/3) clay films on faces of peds; common medium distinct yellowish brown (10YR 5/8) masses of iron accumulation with sharp boundaries along faces of peds; neutral; clear wavy boundary.

2C—60 to 80 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; about 2 percent fine gravel; slightly effervescent; moderately alkaline.

Depth to the 2B/E horizon and redoximorphic accumulations ranges from 20 to 36 inches. The content of gravel ranges from 0 to 5 percent in the sandy upper part of the solum and from 2 to 8 percent in the clayey lower part of the solum. The content of cobbles ranges from 0 to 5 percent in the sandy upper part of the solum. Depth to free calcium carbonates ranges from 30 to 50 inches. The clay content in the argillic horizon ranges from 35 to 60 percent.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Texture is dominantly sand but the range includes loamy sand.

An E horizon occurs in uncultivated areas. It has colors and textures similar to those of the E part of the 2B/E horizon.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. It is sand or loamy sand.

The Bs2 and Bs3 horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Texture is sand or loamy sand.

The B part of the 2B/E horizon and the 2Bt horizon have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. Texture is silty clay loam or silty clay.

The E part of the 2B/E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. It is loamy sand or sand.

The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or silty clay.

Kinross Series

The Kinross series consists of very poorly drained, rapidly permeable soils on outwash plains, remnant moraines, kame moraines, and lake plains. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent. The soils are classified as sandy, mixed, frigid Typic Endoaquods.

Typical pedon of Kinross muck in an area of Kinross-Au Gres complex, 0 to 3 percent slopes; 650 feet east and 250 feet north of the southwestern corner of sec. 31, T. 25 N., R. 5 W.; USGS Fletcher topographic quadrangle; lat. 44 degrees 38 minutes 28 seconds N. and long. 84 degrees 58 minutes 13 seconds W.; Garfield Township:

Oa—0 to 2 inches; black (7.5YR 2.5/1) broken face and rubbed muck; about 60 percent fiber, 10 percent rubbed; moderate medium subangular blocky structure; friable; common fine roots; slightly acid; abrupt wavy boundary.

E1—2 to 5 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; single grain; loose; common fine, medium, and coarse roots; very strongly acid; clear wavy boundary.

E2—5 to 20 inches; light brownish gray (10YR 6/2) sand, light gray (10YR 7/2) dry; single grain; loose; few fine roots; common fine faint grayish brown (10YR 5/2) masses of iron depletion with diffuse boundaries along root channels and on faces of peds; very strongly acid; clear wavy boundary.

Bhs—20 to 30 inches; dark brown (7.5YR 3/2) sand; single grain; loose; common coarse distinct brown (7.5YR 5/2) masses of iron depletion with diffuse boundaries on faces of peds; about 5 percent of the horizon is occupied by weakly cemented ortstein; strongly acid; clear wavy boundary.

BC—30 to 48 inches; dark brown (7.5YR 3/4) sand; single grain; loose; many coarse distinct brown (7.5YR 5/2) masses of iron depletion with diffuse boundaries on faces of peds; about 5 percent of the horizon is occupied by weakly cemented ortstein; strongly acid; clear wavy boundary.

C—48 to 80 inches; yellowish brown (10YR 5/4) sand; single grain; loose; many fine faint gray (10YR 6/1) masses of iron depletion with diffuse boundaries on faces of peds; very strongly acid.

The content of fine gravel ranges from 0 to 5 percent throughout the profile.

The Oa horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has chroma of 0 to 2. It is muck.

The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. It is sand.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is sand.

The BC horizon has hue of 5YR to 10YR, value of 3 to 6, and chroma of 4 to 6. It is sand.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is sand.

Klacking Series

The Klacking series consist of well drained, moderately rapidly permeable soils on outwash plains, kame moraines, and remnant moraines. These soils formed in sandy and loamy deposits. Slope ranges from 0 to 45 percent. The soils are classified as loamy, mixed, semiactive, frigid Arenic Glossudalfs.

Typical pedon of Klacking loamy sand in an area of Graycalm-Klacking complex, 0 to 6 percent slopes; 970 feet north and 20 feet east of the southwestern corner of sec. 13, T. 25 N., R. 5 W.; USGS Cote Dame Marie topographic quadrangle; lat. 44 degrees 33 minutes 26 seconds N. and long. 84 degrees 52 minutes 12 seconds W.; Garfield Township:

A—0 to 2 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and common medium and coarse roots; about 1 percent fine gravel; very strongly acid; abrupt wavy boundary.

Bw—2 to 21 inches; yellowish brown (10YR 5/6) loamy sand; weak medium subangular blocky structure; very friable; common fine, medium, and coarse roots; about 3 percent fine gravel; strongly acid; clear wavy boundary.

E and Bt—21 to 33 inches; light yellowish brown (10YR 6/4) sand (E part), very pale brown (10YR 7/4) dry; few strong brown (7.5YR 5/6) loamy sand lamellae (Bt part); weak medium subangular blocky structure in E part; weak fine granular structure in Bt part; very friable; common coarse and few medium and fine roots; clay bridging between sand grains; lamellae are 1/8 to 1/2 inch thick; about 3 percent fine and medium gravel; strongly acid; clear irregular boundary.

B/E—33 to 51 inches; dark yellowish brown (10YR 4/4) sandy loam (Bt part); Bt part occupies 80 percent of the horizon and is surrounded by remnants of yellowish brown (10YR 5/4) loamy sand (E part), light gray (10YR 7/2) dry; moderate medium subangular blocky structure; friable; few fine and medium roots; colloidal clay in bridges between sand grains; moderately acid; abrupt irregular boundary.

E and Bt´—51 to 80 inches; very pale brown (10YR 7/4) sand (E part), very pale brown (10YR 7/3)

dry; strong brown (7.5YR 4/6) loamy sand lamellae (Bt part); single grain in E part; weak fine granular structure in Bt part; loose in E part and very friable in Bt part; clay bridging between sand grains; lamellae are 1/8 inch to 2 inches thick and total accumulation of lamellae is more than 6 inches; about 3 percent fine gravel; moderately acid.

The content of gravel ranges from 1 to 14 percent and the content of cobbles ranges from 0 to 5 percent throughout the profile. Depth to the first lamellae ranges from 36 to 50 inches. The clay content ranges from 8 to 18 percent in the argillic horizon.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly loamy sand but the range includes sand.

The Bw horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is loamy sand or sand.

The E part of the E and Bt horizon and B/E horizon has hue of 10YR, value of 5 to 7, and chroma of 2 to 4. It is sand or loamy sand.

The B part of the E and Bt horizon and B/E horizon has hue of 5YR to 10YR and value and chroma of 4 to 6. It is loamy sand or sandy loam. Lamellae of the E and Bt horizon range from 1/8 inch to 4 inches in thickness, and the accumulation of lamellae is more than than 6 inches.

Leafriver Series

The Leafriver series consists of very poorly drained soils on kame moraines, lake plains, and outwash plains. These soils formed in woody material that is 8 to 16 inches thick over sandy deposits. Permeability is moderate or moderately rapid in the organic material and rapid in the sandy underlying material. Slope ranges from 0 to 2 percent. The soils are classified as sandy, mixed, frigid Histic Humaquepts.

Typical pedon of Leafriver muck in an area of Tawas-Leafriver mucks; 3,300 feet north and 400 feet west of the southeastern corner of sec. 30, T. 27 N., R. 7 W.; USGS Kalkaska topographic quadrangle; lat. 44 degrees 42 minutes 20 seconds N. and long. 85 degrees 12 minutes 2 seconds W.; Kalkaska Township:

Oa1—0 to 12 inches; black (7.5YR 2.5/1) broken face and rubbed muck; about 15 percent fiber, 10 percent rubbed; moderate medium subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.

Oa2—12 to 14 inches; black (N 2/0) broken face and rubbed muck; about 10 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

2Cg—14 to 19 inches; light brownish gray (10YR 6/2) sand; weak fine granular structure; very friable; about 2 percent fine gravel; neutral; gradual wavy boundary.

2C—19 to 80 inches; brown (10YR 5/3) sand; weak fine granular structure; very friable; about 2 percent fine gravel; neutral.

The thickness of the sapric material ranges from 8 to 16 inches. The content of woody fragments ranges from 0 to 5 percent in the organic layers. The content of fine and medium gravel ranges from 0 to 10 percent in the C horizon.

The Oa horizon has hue of 5YR to 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is muck.

The 2C horizon has hue of 10YR, value of 2 to 6, and chroma of 1 to 4. It is sand.

Lindquist Series

The Lindquist series consist of somewhat exessively drained, rapidly permeable soils on kame moraines, kames, remnant moraines, outwash plains, and stream terraces. These soils formed in sandy deposits. Slope ranges from 0 to 35 percent. The soils are classified as sandy, mixed, frigid Lamellic Haplorthods.

Typical pedon of Lindquist sand, 0 to 6 percent slopes; 1,800 feet west and 650 feet south of the northeastern corner of sec. 10, T. 26 N., R. 8 W.; USGS South Boardman topographic quadrangle; lat. 44 degrees 40 minutes 6 seconds N. and long. 85 degrees 15 minutes 33 seconds W.; Boardman Township:

Oe—0 to 1 inch; dark brown (7.5YR 3/2) partially decomposed forest litter.

A—1 to 2 inches; black (N 2/0) sand, gray (10YR 5/1) dry; weak medium granular structure; very friable; many fine and medium and common coarse roots; about 1 percent fine gravel; very strongly acid; abrupt smooth boundary.

E—2 to 5 inches; brown (7.5YR 5/2) sand, light gray (10YR 7/2) dry; weak medium granular structure; very friable; common fine, medium, and coarse roots; about 1 percent fine gravel; very strongly acid; clear irregular boundary.

Bs1—5 to 13 inches; brown (7.5YR 4/4) sand; weak fine subangular blocky structure; very friable; common fine, medium, and coarse roots; about 1 percent fine gravel; strongly acid; clear irregular boundary.

Bs2—13 to 22 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure; very

friable; few fine, common medium, and few coarse roots; about 3 percent fine gravel; moderately acid; clear wavy boundary.

Bs3—22 to 34 inches; strong brown (7.5YR 5/6) sand; weak medium granular structure; very friable; few fine and medium roots; about 3 percent fine gravel; moderately acid; clear wavy boundary.

E´—34 to 39 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/4) dry; weak medium subangular blocky structure; very friable; few medium roots; about 1 percent fine gravel; moderately acid; abrupt broken boundary.

E´ and Bt—39 to 77 inches; light yellowish brown (10YR 6/4) sand (E´ part), very pale brown (10YR 7/4) dry; strong brown (7.5YR 4/6) loamy sand lamellae (Bt part); single grain in E´ part; weak fine granular structure in Bt part; loose in E´ part and very friable in Bt part; few fine roots; clay bridging between sand grains; lamellae are $^1/_8$ to $^1/_2$ inch thick and total accumulation of lamellae is less than 6 inches; about 1 percent fine gravel; slightly acid; abrupt broken boundary.

2C—77 to 80 inches; pale brown (10YR 6/3) sand; single grain; loose; about 3 percent fine gravel; neutral.

The content of fine gravel ranges from 0 to 14 percent and the content of cobbles ranges from 0 to 5 percent throughout the profile. Depth to the first lamellae ranges from 35 to 55 inches. The content of ortstein ranges from 0 to 35 percent in the Bs and E´ horizons.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 3. It is sand.

The Bs1 horizon has hue of 7.5YR, value of 3 or 4, and chroma of 2 to 4. Value of 3 and chroma of 2 or 3 do not occur together. Texture is sand.

The Bs2 and Bs3 horizons have hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 8. Texture is sand.

The E´ horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is sand.

The E´ part of the E´ and Bt horizon has colors and textures similar to those of the E´ horizon. The Bt part of the E´ and Bt horizon consists of lamellae $^1/_{16}$ inch to 2 inches thick. The accumulation of lamellae within a depth of 80 inches is less than 6 inches thick. The Bt part has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand or sand.

The C horizon has hue of 10YR, value of 4 to 7, and chroma of 3 to 6. It is sand.

Loxley Series

The Loxley series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on kame moraines, outwash plains, and lake plains. These soils formed in herbaceous deposits more than 51 inches thick. Slope ranges from 0 to 2 percent. The soils are classified as dysic, frigid Typic Haplosaprists.

Typical pedon of Loxley mucky peat in an area of Dawson-Loxley peats; 4,200 feet west and 10 feet north of the southeastern corner of sec. 26, T. 26 N., R. 8 W.; USGS Smithville topographic quadrangle; lat. 44 degrees 36 minutes 43 seconds N. and long. 85 degrees 14 minutes 53 seconds W.; Boardman Township:

Oe1—0 to 12 inches; dark reddish brown (5YR 2.5/2) broken face and rubbed mucky peat (hemic material); about 55 percent fiber, 20 percent rubbed; massive; friable; very strongly acid; abrupt smooth boundary.

Oe2—12 to 21 inches; black (5YR 2.5/1) broken face and rubbed mucky peat (hemic material); about 55 percent fiber, 20 percent rubbed; massive; friable; extremely acid; clear smooth boundary.

Oa—21 to 80 inches; black (5YR 2.5/1) broken face and rubbed muck (sapric material); about 55 percent fiber, 15 percent rubbed; massive; friable; very strongly acid.

The content of woody fragments ranges from 0 to 5 percent throughout the profile. In some pedons there is a surface covering of sphagnum as much as 12 inches thick. Depth of the organic layers is more than 51 inches. Organic fibers are derived primarily from herbaceous material.

The surface tier has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly mucky peat but the range includes peat.

The subsurface tier has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is muck.

Lupton Series

The Lupton series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on kame moraines, lake plains, and outwash plains. These soils formed in woody material more than 51 inches thick. Slope ranges from 0 to 2 percent. The soils are classified as euic, frigid Typic Haplosaprists.

Typical profile of Lupton muck in an area of Tawas-Lupton mucks; 1,300 feet north and 2,350 feet east of the southwestern corner of sec. 22, T. 26 N., R. 8 W.; USGS South Boardman topographic quadrangle; lat. 44 degrees 37 minutes 49 seconds N. and long. 85 degrees 15 minutes 50 seconds W.; Boardman Township:

Oa1—0 to 10 inches; black (N 2/0) broken face and rubbed muck; about 5 percent fiber, less than 1 percent rubbed; weak medium granular structure; friable; many fine and common medium roots; neutral; abrupt wavy boundary.

Oa2—10 to 34 inches; black (5YR 2.5/1) broken face and rubbed muck; about 10 percent fiber, 5 percent rubbed; massive; friable; about 5 percent woody fragments; neutral; clear wavy boundary.

Oa3—34 to 80 inches; black (5YR 2.5/1) broken face and rubbed muck; about 5 percent fiber, less than 1 percent rubbed; massive; friable; about 2 percent woody fragments; neutral.

The thickness of the sapric material is more than 51 inches. The content of woody fragments ranges from 0 to 10 percent.

The Oa1 horizon has hue of 5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is muck.

Some pedons have an Oe horizon. This horizon is muck.

The Oa2 and Oa3 horizons have hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or they are neutral in hue and have value of 2 or 3. Texture is muck.

Mancelona Series

The Mancelona series consists of somewhat excessively drained soils on outwash plains, kame moraines, and stream terraces. These soils formed in sandy and gravelly deposits. Permeability is moderately rapid in the subsoil and very rapid in the gravelly underlying material. Slope ranges from 0 to 55 percent. The soils are classified as sandy, mixed, frigid Alfic Haplorthods.

Typical pedon of Mancelona sand in an area of Rubicon, calcareous substratum-Mancelona sands, 12 to 18 percent slopes; 2,000 feet south and 900 feet east of the northwestern corner of sec. 33, T. 28 N., R. 85 W.; USGS Torch River topographic quadrangle; lat. 44 degrees 46 minutes 57 seconds N. and long. 85 degrees 17 minutes 6 seconds W.; Clearwater Township:

A—0 to 3 inches; black (10YR 2/1) sand, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; many fine and medium and few coarse roots; about 3 percent fine gravel; neutral; abrupt smooth boundary.

E—3 to 7 inches; dark grayish brown (10YR 4/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine, medium, and coarse roots; about 5 percent fine and medium gravel; slightly acid; clear irregular boundary.

Bs—7 to 21 inches; dark brown (7.5YR 3/4) sand; weak fine granular structure; very friable; few fine and coarse and common medium roots; about 5 percent fine and medium gravel; moderately acid; abrupt wavy boundary.

2E/B—21 to 24 inches; grayish brown (10YR 5/2) loamy sand (E part), light gray (10YR 7/2) dry; E part occupies 70 percent of the horizon as tongues extending into or completely surrounding isolated remnants of reddish brown (5YR 4/3) sandy loam (Bt part); weak medium subangular blocky structure; friable; common fine and medium roots; about 3 percent fine and medium gravel; neutral; clear broken boundary.

2Bt—24 to 35 inches; reddish brown (5YR 4/3) sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; clay bridging between sand grains; about 10 percent fine and medium gravel; slightly effervescent; slightly alkaline; abrupt irregular boundary.

3C—35 to 80 inches; light yellowish brown (10YR 6/4) very gravelly sand; single grain; loose; about 55 percent fine and medium gravel and about 10 percent coarse gravel; strongly effervescent; moderately alkaline.

Depth to free calcium carbonates ranges from 24 to 40 inches. The content of fine and medium gravel ranges from 3 to 20 percent in the solum. The content of gravel ranges from 10 to 55 percent in the substratum. Individual strata of gravel make up 15 to 70 percent of the substratum. The content of cobbles ranges from 0 to 10 percent. The clay content ranges from 5 to 15 percent in the argillic horizon.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly sand but the range includes loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is sand or loamy sand.

The Bs horizon has hue of 5YR to 10YR and value and chroma of 3 or 4. It is sand or loamy sand.

The E part of the 2E/B horizon has textures and colors similar to those of the E horizon.

The B part of the 2E/B horizon and the 2Bt horizon have hue of 5YR to 10YR, value of 3 or 4, and chroma of 3 to 6. They are sandy loam or loamy sand or the gravelly analogues of those textures.

The 3C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is very gravelly sand or stratified gravelly sand and sand.

Menominee Series

The Menominee series consists of well drained soils on kame moraines and lake plains. These soils formed in sandy deposits overlying loamy glaciolacustrine and glacial till deposits. Permeability is rapid in the upper sandy material and moderately slow in the loamy underlying material. Slope ranges from 12 to 18 percent. The soils are classified as sandy over loamy, mixed, active, frigid Alfic Haplorthods.

Typical pedon of Menominee sand in an area of Islandlake-Menominee sands, 12 to 18 percent slopes; 310 feet south and 25 feet east of the northwestern corner of sec. 32, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 31 minutes 34 seconds N. and long. 85 degrees 18 minutes 47 seconds W.; Springfield Township:

A—0 to 4 inches; black (10YR 2/1) sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and few medium and coarse roots; very strongly acid; abrupt wavy boundary.

E—4 to 7 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; weak fine granular structure; very friable; common fine, medium, and coarse roots; about 1 percent fine gravel; very strongly acid; clear irregular boundary.

Bs1—7 to 12 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; about 1 percent fine gravel; strongly acid; clear wavy boundary.

Bs2—12 to 30 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure parting to weak medium granular; very friable; common fine and few medium and coarse roots; about 1 percent fine gravel; strongly acid; abrupt wavy boundary.

E´—30 to 33 inches; brown (10YR 5/3) loamy sand, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; very friable; few fine and medium roots; about 1 percent fine gravel; strongly acid; clear broken boundary.

2B/E—33 to 38 inches; reddish brown (5YR 4/3) clay loam (Bt part); moderate medium subangular blocky structure; firm; few fine roots; thin reddish brown (2.5YR 4/4) clay films on faces of peds; Bt part occupies about 60 percent of the horizon and is completely surrounded by or penetrated by tongues of brown (10YR 5/3) loamy sand (E part), pale brown (10YR 6/3) dry; moderately acid; clear wavy boundary.

2Bt—38 to 43 inches; brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin reddish brown (2.5YR 4/4) clay films on faces of peds; moderately acid; abrupt wavy boundary.

2E and Bt—43 to 58 inches; pale brown (10YR 6/3) sand, light gray (10YR 7/2) dry (E part); lamellae and bands of brown (7.5YR 4/4) sandy loam (Bt part); single grain in E part; weak fine granular structure in Bt part; loose in E part and friable in Bt part; few fine roots; clay bridging between sand grains; about 3 percent fine gravel; moderately acid; abrupt irregular boundary.

2C—58 to 80 inches; brown (7.5YR 4/3) silty clay loam; massive; firm; few fine roots; slightly effervescent; slightly alkaline.

Depth to the 2B/E horizon ranges from 20 to 36 inches. Depth to free calcium carbonates ranges from 35 to 55 inches. The content of gravel ranges from 0 to 5 percent in the A, E, Bs, and E´ horizons and from 0 to 8 percent in the loamy lower part of the solum. The content of cobbles ranges from 0 to 5 percent throughout the profile. The clay content of the argillic horizon ranges from 10 to 35 percent.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly sand but the range includes loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 or 3. It is sand or loamy sand.

The Bs1 horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. Value of 3 and chroma of 3 do not occur together. Texture is sand or loamy sand.

The Bs2 horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand.

The E´ horizon has hue of 10YR, value of 4 to 7, and chroma of 2 to 4. It is sand.

The B part of the 2B/E horizon and the 2Bt horizon have hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. They are clay loam, sandy loam, or silty clay loam.

The E part of the 2B/E horizon has colors similar to those of the E´ horizon. It is loamy sand or sand.

The E part of the 2E and Bt horizon has colors and textures similar to those of the E´ horizon. The B part of the 2E and Bt horizon has lamellae 1/8 inch to 3 inches thick. It has hue of 7.5YR or 10YR, value of 4

or 5, and chroma of 3 to 6. It is loamy sand or sandy loam.

The 2C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam or clay loam.

Montcalm Series

The Montcalm series consists of well drained, moderately rapidly permeable soils on outwash plains and kame moraines. These soils formed in sandy deposits. Slope ranges from 0 to 6 percent. The soils are classified as coarse-loamy, mixed, semiactive, frigid Alfic Haplorthods.

Typical pedon of Montcalm loamy sand in an area of Hodenpyl-Montcalm complex, 0 to 6 percent slopes; 1,850 feet east and 950 feet south of the northwestern corner of sec. 30, T. 25 N., R. 5 S.; USGS Fletcher topographic quadrangle; lat. 44 degrees 32 minutes 13 seconds N. and long. 85 degrees 57 minutes 49 seconds W.; E. Garfield Township:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine and medium roots; about 3 percent fine gravel; neutral; abrupt wavy boundary.

E—7 to 10 inches; pale brown (10YR 6/3) loamy sand, light gray (10YR 7/2) dry; weak fine granular structure; very friable; common fine and medium roots; about 1 percent fine gravel; slightly acid; clear irregular boundary.

Bs—10 to 17 inches; brown (7.5YR 4/4) loamy sand; weak fine granular structure; very friable; common fine and medium roots; about 3 percent fine gravel; moderately acid; clear wavy boundary.

E´—17 to 23 inches; yellowish brown (10YR 5/4) loamy sand, light yellowish brown (10YR 6/4) dry; weak fine granular structure; very friable; common fine and few medium roots; about 3 percent fine gravel; moderately acid; clear broken boundary.

E/B—23 to 30 inches; brown (10YR 5/3) loamy sand (E part); E part occupies 85 percent of the horizon and extends into isolated remnants of yellowish brown (10YR 5/4) sandy loam (Bt part); weak fine granular structure in E part; moderate medium subangular blocky structure in Bt part; very friable in E part and friable in Bt part; common fine and few medium roots; clay bridging between sand grains; about 3 percent fine gravel; moderately acid; clear irregular boundary.

B/E—30 to 46 inches; dark yellowish brown (10YR 4/4) sandy loam (Bt part); Bt part occupies about 60 percent of the horizon and is intermingled with yellowish brown (10YR 5/4) loamy sand (E part); moderate medium subangular blocky structure; friable; few fine roots; clay bridging between sand grains; about 3 percent fine gravel; slightly acid; clear broken boundary.

E and Bt—46 to 80 inches; light yellowish brown (10YR 6/4) sand (E part); lamellae and bands of dark yellowish brown (10YR 4/4) loamy sand (Bt part); single grain in E part; weak fine granular structure in Bt part; loose in E part and very friable in Bt part; few fine roots; clay bridging between sand grains; about 3 percent fine gravel; neutral.

Depth to free carbonates ranges from 26 to 40 inches. The content of gravel ranges from 1 to 10 percent and the content of cobbles ranges from 0 to 2 percent throughout the profile. The content of clay in the argillic horizon ranges from 5 to 18 percent.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly loamy sand but the range includes sandy loam.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. It is loamy sand or sandy loam.

The Bs horizon has hue of 7.5YR and value and chroma of 3 or 4. It is loamy sand or sand.

The E´ horizon and the E part of the E/B horizon have hue of 10YR, value of 5 to 7, and chroma of 2 to 4. Texture is loamy sand or sand.

The B part of the E/B horizon has colors and textures similar to those of the B part of the B/E horizon.

The B part of the B/E horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sandy loam.

The E part of the E and Bt horizon has colors similar to those of the E´ horizon. It is sand. The Bt part of the E and Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand or sandy loam.

Morganlake Series

The Morganlake series consists of moderately well drained soils on kame moraines. These soils formed in sandy deposits overlying loamy deposits. Permeability is rapid in the sandy material and moderately slow in the loamy material. Slope ranges from 0 to 12 percent. The soils are classified as sandy over loamy, mixed, active, frigid Alfic Oxyaquic Haplorthods.

Typical pedon of Morganlake loamy sand, sandy substratum, 0 to 6 percent slopes; 2,450 feet south and 2,500 feet east of the northwestern corner of sec. 10, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 34 minutes 37 seconds N.

and long. 85 degrees 15 minutes 45 seconds W.; Springfield Township:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; strongly acid; abrupt smooth boundary.

E—6 to 7 inches; brown (7.5YR 5/2) loamy sand, light gray (10YR 7/1) dry; weak medium subangular blocky structure; very friable; few very dark gray (10YR 3/1) organic stains along root channels and pores; about 1 percent fine gravel; strongly acid; abrupt broken boundary.

Bs1—7 to 11 inches; brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; about 1 percent fine gravel; moderately acid; clear wavy boundary.

Bs2—11 to 22 inches; strong brown (7.5YR 4/6) sand; weak fine granular structure; very friable; about 1 percent fine gravel; moderately acid; clear wavy boundary.

2E/B—22 to 35 inches; light brownish gray (10YR 6/2) loamy fine sand (E part), light gray (10YR 7/2) dry; E part occupies about 70 percent of the horizon and extends into isolated remnants of brown (7.5YR 4/3) sandy loam (Bt part); weak coarse subangular blocky structure; friable; many fine pores; brittle when dry; few medium distinct strong brown (7.5YR 4/6) masses of iron accumulation with diffuse boundaries along faces of peds; about 1 percent fine gravel; neutral; clear irregular boundary.

2Bt1—35 to 42 inches; brown (7.5YR 4/3) fine sandy loam; moderate medium subangular blocky structure; firm; colloidal clay in bridges between sand grains; few medium distinct strong brown (7.5YR 4/6) masses of iron accumulation with diffuse boundaries along faces of peds; about 1 percent fine gravel; neutral; clear wavy boundary.

2Bt2—42 to 49 inches; brown (7.5YR 4/3) clay loam; moderate medium subangular blocky structure; firm; thin dark brown (7.5YR 3/3) clay films on faces of peds; few medium distinct strong brown (7.5YR 4/6) masses of iron accumulation with diffuse boundaries along faces of peds; about 1 percent fine gravel; neutral; clear irregular boundary.

2C1—49 to 66 inches; brown (10YR 5/3) sandy clay loam; moderate thick platy structure; firm; few medium prominent strong brown (7.5YR 4/6) masses of iron accumulation with diffuse boundaries along faces of peds; about 1 percent fine gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

2C2—66 to 80 inches; stratified pale brown (10YR 6/3) sand; single grain; loose; brown (10YR 4/3) sandy loam lamellae; lamellae are massive and friable; common fine faint light brownish gray (10YR 6/2) masses of iron depletion with diffuse boundaries along faces of peds; about 3 percent fine gravel; neutral.

Depth to the loamy material ranges from 20 to 36 inches. The content of gravel ranges from 0 to 5 percent throughout the profile. The clay content of the argillic horizon ranges from 10 to 35 percent. Depth to redoximorphic features ranges from 30 to 40 inches.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 2 or 3. Texture is dominantly loamy sand but the range includes sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is loamy sand or sand.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. It is loamy sand or sand.

The Bs2 horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sand or loamy sand.

The E part of the 2E/B horizon has colors and textures similar to those of the E horizon. The Bt part of the 2E/B horizon and the Bt horizon have hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 2 or 3. Texture is sandy loam, fine sandy loam, or clay loam.

The C horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. It is loam, sandy clay loam, or fine sandy loam.

The 2C horizon has hue of 10YR, value of 4 to 7, and chroma of 3 to 6. It is sand. Thin lamellic bands occur in some pedons. They have hue of 7.5YR, value of 3 to 5, and chroma of 3 to 6. They are sandy loam, loamy sand, or sand.

Negwegon Series

The Negwegon series consists of moderately well drained, very slowly permeable soils on lake plains. These soils formed in clayey and silty glaciolacustrine deposits. Slope ranges from 2 to 12 percent. The soils are classified as fine, mixed, semiactive, frigid Oxyaquic Glossudalfs.

Typical pedon of Negwegon silt loam, 2 to 6 percent slopes; 2,100 feet south and 750 feet east of the northwestern corner of sec. 32, T. 28 N., R. 8 W.; USGS Torch River topographic quadrangle; lat. 44 degrees 46 minutes 53 seconds N. and long. 85 degrees 18 minutes 35 seconds W.; Clearwater Township:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry;

moderate medium granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

B/E—6 to 16 inches; brown (7.5YR 4/4) silty clay (Bt part); Bt part occupies about 80 percent of the horizon and is surrounded by brown (10YR 5/3) silt loam (E part), light gray (10YR 7/2) dry; moderate medium angular blocky structure; firm; many fine and common medium roots; many reddish brown (5YR 4/4) clay films on faces of peds; common very dark gray (10YR 3/1) organic stains along worm and root channels; few fine distinct strong brown (7.5YR 5/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; neutral; clear irregular boundary.

Bt—16 to 25 inches; brown (7.5YR 4/4) silty clay; moderate medium angular blocky structure; firm; common fine and few medium roots; many reddish brown (5YR 4/4) clay films on faces of peds; few very dark gray (10YR 3/1) organic stains along worm and root channels; few medium distinct yellowish brown (10YR 5/8) masses of iron accumulation with sharp boundaries along faces of peds; neutral; abrupt wavy boundary.

C1—25 to 47 inches; light olive brown (2.5Y 5/4) and light brownish gray (2.5Y 6/2) silt loam; moderate medium subangular blocky structure; friable; about 1 percent medium gravel; common light gray (10YR 7/1) masses of calcium carbonate accumulation; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2—47 to 80 inches; stratified light olive brown (2.5Y 5/4) silty clay loam and light yellowish brown (2.5Y 6/4) silt loam; weak medium platy structure parting to weak fine angular blocky; friable; about 1 percent medium gravel; strongly effervescent; moderately alkaline.

The content of fine gravel ranges from 0 to 5 percent throughout the profile. The content of cobbles is 0 to 1 percent in the surface layer. Depth to free calcium carbonates ranges from 25 to 36 percent. The clay content of the argillic horizon ranges from 35 to 60 percent.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is silt loam.

The E part of the B/E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. It has textures similar to those of the Ap horizon. The B part of the B/E horizon has colors and textures similar to those of the underlying Bt horizon.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is silty clay or clay.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is stratified silt loam and silty clay loam. Areas of silt loam are of minor extent.

Roscommon Series

The Roscommon series consists of very poorly drained, rapidly permeable soils on outwash plains, on lake plains, and in glacial drainageways. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent. The soils are classified as mixed, frigid Mollic Psammaquents.

Typical pedon of Roscommon mucky sand; 1,200 feet south and 950 feet east of the northwestern corner of sec. 36, T. 26 N., R. 6 W.; USGS Black Creek topographic quadrangle; lat. 44 degrees 41 minutes 44 seconds N. and long. 84 degrees 59 minutes 20 seconds W.; Excelsior Township:

A—0 to 9 inches; black (N 2/0) mucky sand; weak medium granular structure; friable; many fine and common medium and coarse roots; moderately acid; abrupt wavy boundary.

Cg—9 to 15 inches; light brownish gray (10YR 6/2) sand; weak fine granular structure; very friable; common fine and medium roots; common black (10YR 2/1) organic stains along root channels and pores; about 1 percent fine gravel; neutral; abrupt wavy boundary.

C1—15 to 22 inches; brown (10YR 4/3) sand; weak fine subangular blocky structure; very friable; few fine roots; few fine distinct light brownish gray (10YR 6/2) masses of iron depletion with diffuse boundaries on faces of peds; about 1 percent fine gravel; neutral; clear wavy boundary.

C2—22 to 32 inches; brown (10YR 5/3) sand; single grain; loose; thin layer of dark brown (7.5YR 3/2) organic stains; common medium faint light brownish gray (10YR 6/2) masses of iron depletion with diffuse boundaries on faces of peds; about 1 percent fine gravel; neutral; clear wavy boundary.

C´g1—32 to 55 inches; brown (2.5Y 5/2) sand; single grain; loose; about 1 percent fine gravel; neutral; clear wavy boundary.

C´g2—55 to 80 inches; pale brown (10YR 6/2) sand; single grain; loose; about 1 percent fine gravel; neutral.

The content of fine gravel ranges from 0 to 10 percent throughout the profile. Depth to redoximorphic depletions ranges from 8 to 20 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is dominantly mucky sand or sand.

Some pedons have a thin Oa horizon.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is sand.

Rubicon Series

The Rubicon series consist of exessively drained, rapidly permeable soils on kame moraines, remnant moraines, outwash plains, and stream terraces. These soils formed in sandy deposits. Slope ranges from 0 to 55 percent. The soils are classified as sandy, mixed, frigid Entic Haplorthods.

Typical pedon of Rubicon sand, 0 to 6 percent slopes; 700 feet north and 65 feet east of the southwestern corner of sec. 32, T. 27 N., R. 8 W.; USGS South Boardman topographic quadrangle; lat. 44 degrees 45 minutes 11 seconds N. and long. 85 degrees 18 minutes 46 seconds W.; Kalkaska Township:

Oe—0 to 1 inch; very dark gray (10YR 3/1) partially decomposed forest litter.

A—1 to 3 inches; black (N 2/0) sand; weak fine granular structure; very friable; many fine and common medium roots; about 1 percent fine gravel; very strongly acid; abrupt smooth boundary.

E—3 to 6 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; about 2 percent gravel; very strongly acid; clear irregular boundary.

Bs1—6 to 11 inches; brown (7.5YR 4/4) sand; weak medium granular structure parting to single grain; very friable; many medium, common fine, and few fine roots; about 3 percent fine gravel; strongly acid; clear irregular boundary.

Bs2—11 to 28 inches; strong brown (7.5YR 4/6) sand; single grain; loose; common medium and few fine and coarse roots; about 3 percent fine gravel; moderately acid; clear wavy boundary.

BC—28 to 34 inches; yellowish brown (10YR 5/6) sand; single grain; loose; common medium and few fine roots; about 5 percent fine gravel; slightly acid; clear wavy boundary.

C1—34 to 56 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 5 percent fine gravel; slightly acid; gradual wavy boundary.

C2—56 to 80 inches; pale brown (10YR 6/3) sand; single grain; loose; about 3 percent fine gravel; slightly acid.

The content of fine gravel ranges from 0 to 14 percent throughout the profile. The content of ortstein ranges from 0 to 10 percent in the Bs and BC horizons.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 3. It is sand.

The Bs1 horizon has hue of 7.5YR, value of 3 or 4, and chroma of 2 to 4. Value of 3 and chroma of 2 or 3 do not occur together. Texture is sand. The horizon is 4 to 12 inches thick.

The Bs2 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 8. It is sand.

The BC horizon has hue of 10YR, value of 4 to 6, and chroma of 4 to 8. It is sand.

The C horizon has hue of 10YR, value of 4 to 7, and chroma of 3 to 6. It is sand. Calcareous substratum phases are recognized.

Southwells Series

The Southwells series consists of well drained, moderately rapidly permeable soils on kame moraines and kames. These soils formed in sandy and loamy deposits. Slope ranges from 0 to 50 percent. The soils are classified as sandy, mixed, frigid Alfic Haplorthods.

Typical pedon of Southwells loamy sand in an area of Islandlake-Southwells complex, 12 to 18 percent slopes (fig. 19); 850 feet south and 2,550 feet west of the northeastern corner of sec. 16, T. 28 N., R. 6 W.; USGS Westwood topographic quadrangle; lat. 44 degrees 49 minutes 39 seconds N. and long. 85 degrees 2 minutes 25 seconds W.; Coldsprings Township:

A—0 to 1 inch; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine, common medium, and few coarse roots; about 3 percent fine gravel; strongly acid; abrupt wavy boundary.

E—1 to 3 inches; brown (7.5YR 4/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak fine granular structure; very friable; common fine and few coarse roots; about 3 percent fine gravel; strongly acid; clear irregular boundary.

Bs1—3 to 13 inches; dark brown (7.5YR 3/4) loamy sand; weak medium granular structure; very friable; many fine, common medium, and few coarse roots; about 5 percent fine gravel; strongly acid; clear wavy boundary.

Bs2—13 to 25 inches; brown (7.5YR 4/4) sand; weak fine granular structure; very friable; common fine and few medium and coarse roots; about 5

percent fine gravel; strongly acid; clear irregular boundary.

E/B—25 to 57 inches; pale brown (10YR 6/3) sand (E part), light gray (10YR 7/2) dry; E part occupies 65 percent of the horizon and extends into isolated remnants of dark yellowish brown (10YR 4/4) loamy sand (Bt part); Bt part also can occur as lamellae 1/4 to 1 inch thick; single grain in E part; weak fine granular structure in Bt part; loose in E part and very friable in Bt part; few fine and medium roots; clay bridging between sand grains; about 5 percent fine gravel; moderately acid; clear irregular boundary.

B/E—57 to 66 inches; dark yellowish brown (10YR 4/4) sandy loam (Bt part); Bt part also can occur as lamellae 1/4 to 1 inch thick; Bt part occupies about 60 percent of the horizon and extends into isolated remnants of pale brown (10YR 6/3) loamy sand (E part), light gray (10YR 7/2) dry; moderate medium subangular blocky structure; friable; clay bridging between sand grains; about 7 percent fine gravel; neutral; abrupt broken boundary.

C1—66 to 73 inches; brown (10YR 5/3) sandy loam; massive; friable; about 7 percent fine gravel; strongly effervescent; moderately alkaline; abrupt broken boundary.

C2—73 to 80 inches; brown (10YR 5/3) sand; single grain; loose; about 7 percent fine gravel; strongly effervescent; moderately alkaline.

Depth to the top of the argillic horizon ranges from 44 to 60 inches. The content of fine and medium gravel ranges from 0 to 14 percent and the content of cobbles ranges from 0 to 3 percent throughout the profile. Depth to free carbonates ranges from 50 to more than 80 inches. The clay content of the argillic horizon ranges from 10 to 20 percent. The content of ortstein in the Bs horizon ranges from 0 to 20 percent.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. In cultivated areas it has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Texture is dominantly loamy sand but the range includes sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. It is loamy sand or sand.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. Value of 3 and chroma of 3 do not occur together. Texture is sand or loamy sand.

The Bs2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand or sand.

The E part of the E/B and B/E horizons has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is sand or loamy sand. The E/B horizon can have fragipan-like characteristics, such as hardness and brittleness when dry, and also contain vesicular pores.

The B part of the E/B and B/E horizons has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam or loamy sand.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam, loamy sand, or sand.

Springlake Series

The Springlake series consists of somewhat excessively drained, very rapidly permeable soils on outwash plains, kame moraines, and stream terraces. These soils formed in sandy and gravelly deposits. Slope ranges from 0 to 35 percent. The soils are classified as sandy, mixed, frigid Typic Haplorthods.

Typical pedon of Springlake sand, 0 to 6 percent slopes; 2,150 feet east and 30 feet south of the northwestern corner of sec. 12, T. 28 N., R. 7 W.; USGS Westwood topographic quadrangle; lat. 44 degrees 50 minutes 36 seconds N. and long. 85 degrees 6 minutes 16 seconds W.; Rapid River Township:

Ap—0 to 3 inches; very dark grayish brown (10YR 3/2) sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine and common medium roots; about 3 percent fine gravel; strongly acid; abrupt wavy boundary.

E—3 to 5 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; strongly acid; clear broken boundary.

Bhs—5 to 7 inches; dark reddish brown (5YR 3/3) sand; weak medium subangular blocky structure; very friable; common fine and medium roots; about 3 percent fine and medium gravel; moderately acid; abrupt broken boundary.

Bs1—7 to 12 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure parting to single grain; very friable; few fine roots; about 3 percent fine and medium gravel; moderately acid; clear wavy boundary.

Bs2—12 to 37 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few fine roots; about 5 percent fine and medium gravel; moderately acid; clear irregular boundary.

2Bt—37 to 40 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; weak medium granular

structure; very friable; few fine and medium roots; about 20 percent fine and medium gravel; slightly effervescent; mildly alkaline; clear irregular boundary.

2C—40 to 80 inches; light yellowish brown (10YR 6/4) stratified sand and gravelly sand; single grain; loose; about 20 percent fine and medium gravel; strongly effervescent; moderately alkaline.

Depth to free calcium carbonates ranges from 30 to 55 inches. The content of gravel ranges from 1 to 10 percent in the upper part of the solum and from 5 to 30 percent in the lower part of the solum and in the substratum. The content of cobbles ranges from 0 to 5 percent in the substratum. The thickness of the 2Bt horizon ranges from 0 to 3 inches. The 2Bt horizon is a non-argillic beta-B horizon.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly sand but the range includes loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2. It is sand or loamy sand.

The Bhs horizon has hue of 5YR and value and chroma of 2 or 3. It is sand or loamy sand.

The Bs horizon has hue of 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sand.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 6. It is gravelly loamy sand or gravelly sand.

The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is stratified gravelly sand and sand.

Springport Series

The Springport series consists of poorly drained, very slowly permeable soils on lake plains. These soils formed in clayey glaciolacustrine deposits. Slope ranges from 0 to 2 percent. The soils are classified as fine, mixed, calcareous, semiactive, frigid Typic Epiaquolls.

Typical pedon of Springport silt loam in an area of Allendale-Springport complex, 0 to 3 percent slopes; 2,010 feet south and 2,500 feet east of the northwestern corner of sec. 32, T. 28 N., R. 6 W.; USGS Westwood topographic quadrangle; lat. 44 degrees 32 minutes 33 seconds N. and long. 85 degrees 15 minutes 12 seconds W.; Coldsprings Township:

A—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak coarse granular structure; friable; many fine and common medium roots; neutral; abrupt wavy boundary.

Bg—8 to 13 inches; gray (5Y 5/1) silty clay; strong medium angular blocky structure; firm; few fine roots; common dark gray (10YR 4/1) organic stains in root channels and in pores; many coarse prominent yellowish brown (10YR 5/6) masses of iron accumulation with sharp boundaries and common fine faint gray (10YR 6/1) masses of iron depletion with diffuse boundaries on faces of peds; neutral; clear wavy boundary.

Btg1—13 to 21 inches; gray (5Y 5/1) silty clay; moderate coarse columnar structure parting to strong medium angular blocky; firm; few fine roots; few dark gray (10YR 4/1) organic stains in root channels and in pores; thin greenish gray (5BG 6/1) clay films on faces of peds; common coarse prominent yellowish brown (10YR 5/6) masses of iron accumulation with sharp boundaries and common fine prominent gray (10YR 6/1) masses of iron depletion with diffuse boundaries on faces of peds; neutral; clear wavy boundary.

Btg2—21 to 29 inches; gray (5Y 5/1) silty clay; moderate medium subangular blocky structure; firm; few fine roots; thick greenish gray (5BG 6/1) clay films on faces of peds; many medium distinct olive brown (2.5Y 4/4) masses of iron accumulation with sharp boundaries on faces of peds; common light gray (10YR 7/1) masses of calcium carbonate accumulation on faces of peds; strongly effervescent; moderately alkaline; clear wavy boundary.

Btg3—29 to 80 inches; gray (5Y 5/1) and olive brown (2.5Y 4/4) silty clay; moderate medium subangular blocky structure; firm; few fine roots; many horizontal and vertical greenish gray (5GB 5/1) veins on faces of peds; thick greenish gray (5BG 6/1) clay films on faces of peds; many light gray (10YR 7/1) masses of calcium carbonate accumulation on faces of peds; strongly effervescent; moderately alkaline.

Depth to free carbonates ranges from 25 to 40 inches. The mollic epipedon is 10 to 15 inches thick. The content of gravel and the content of cobbles are both 0 to 1 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly silt loam but the range includes silt clay loam.

The Bg horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay or silty clay loam.

The Bt horizon has hue of 5Y or 2.5Y, value of 3 to 6, and chroma of 1 to 3. It is silty clay or silty clay loam.

Tawas Series

The Tawas series consists of very poorly drained soils in depressions on kame moraines, lake plains, and outwash plains. These soils formed in woody material that is 16 to 51 inches thick over sandy deposits. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy underlying material. Slope ranges from 0 to 2 percent. The soils are classified as sandy or sandy-skeletal, mixed, euic, frigid Terric Haplosaprists.

Typical pedon of Tawas muck in an area of Tawas-Lupton mucks; 1,500 feet south and 650 feet west of the northeastern corner of sec. 10, T. 26 N., R. 8 W.; USGS South Boardman topographic quadrangle; lat. 44 degrees 39 minutes 46 seconds N. and long. 85 degrees 15 minutes 10 seconds W.; Boardman Township:

Oa1—0 to 7 inches; black (5YR 2/0) broken face and rubbed muck; about 25 percent fiber, 1 percent rubbed; weak medium granular structure; friable; many fine and common medium roots; moderately acid; clear wavy boundary.

Oa2—7 to 13 inches; black (5YR 2/0) broken face and rubbed muck; about 20 percent fiber, 10 percent rubbed; weak medium granular structure; friable; few fine and medium roots; about 2 percent woody fragments; slightly acid; abrupt wavy boundary.

Oa3—13 to 21 inches; black (10YR 2/1) broken face and rubbed muck; about 5 percent fiber, less than 1 percent rubbed; massive; friable; about 25 percent mineral; about 2 percent woody fragments; neutral; abrupt smooth boundary.

2C—21 to 80 inches; brown (10YR 5/3) sand; single grain; loose; about 2 percent fine gravel; neutral.

The thickness of the sapric material ranges from 16 to 50 inches. The content of woody fragments ranges from 0 to 5 percent in the organic layers. The content of fine gravel ranges from 0 to 10 percent in the C horizon.

The Oa horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is muck.

The 2C horizon has hue of 10YR, value of 3 to 6, and chroma of 1 to 3. It is sand or loamy sand.

Udipsamments

Udipsamments consist of exessively drained, rapidly permeable soils on kame moraines, remnant moraines, outwash plains, and lake plains. These soils formed in sandy deposits. Slope ranges from nearly level to very steep.

Typical pedon of Udipsamments, nearly level to very steep; 2,325 feet south and 2,075 feet west of the northeastern corner of sec. 26, T. 25 N., R. 8 W.; USGS Smithville topographic quadrangle; lat. 44 degrees 32 minutes 1 second N. and long. 85 degrees 17 minutes 6 seconds W.; Springfield Township:

C—0 to 80 inches; very pale brown (10YR 7/3) sand; single grain; loose; about 5 percent fine gravel; slightly acid.

The content of fine gravel ranges from 0 to 14 percent throughout the profile.

The C horizon has hue of 10YR, value of 4 to 7, and chroma of 3 to 6. It is sand.

Wakeley Series

The Wakeley series consist of very poorly drained soils on lake plains. These soils formed in sandy deposits overlying clayey glaciolacustrine deposits. Permeability is rapid in the sandy material and very slow in the clayey underlying material. Slope ranges from 0 to 2 percent. The soils are classified as sandy over clayey, mixed, nonacid, semiactive, frigid Aeric Epiaquents.

Typical pedon of Wakeley muck in an area of Wakeley-Allendale complex, 0 to 3 percent slopes (fig. 20); 1,200 feet south and 650 feet west of the northeastern corner of sec. 28, T. 25 N., R. 8 W.; USGS Fife Lake topographic quadrangle; lat. 44 degrees 31 minutes 55 seconds N. and long. 85 degrees 16 minutes 35 seconds W.; Springfield Township:

Oa—0 to 7 inches; black (N 2/0) muck, black (10YR 2/1) dry; weak medium granular structure; friable; many fine and medium and common coarse roots; strongly acid; abrupt wavy boundary.

Cg—7 to 13 inches; dark grayish brown (2.5Y 4/2) sand; weak medium subangular blocky structure parting to weak medium granular; very friable; few medium and fine roots; about 2 percent fine gravel; moderately acid; clear wavy boundary.

C1—13 to 19 inches; light olive brown (2.5Y 5/3) sand; single grain; loose; few fine roots; many coarse distinct grayish brown (10YR 5/2) masses of iron depletion with diffuse boundaries along root channels; about 1 percent fine gravel; moderately acid; clear wavy boundary.

C2—19 to 22 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; few fine roots; few fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation with sharp boundaries along

root channels; about 1 percent fine gravel; moderately acid; abrupt wavy boundary.

2C—22 to 46 inches; yellowish brown (10YR 5/4) silty clay; strong coarse angular blocky structure; very firm; few fine roots; many medium prominent gray (5GY 6/1) masses of iron depletion with sharp boundaries along root channels and on faces of peds; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Cg´—46 to 80 inches; grayish brown (2.5Y 5/2) silty clay; moderate coarse subangular blocky structure; firm; many medium prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and few medium prominent gray (5GY 6/1) masses of iron depletion with sharp boundaries along faces of peds; strongly effervescent; moderately alkaline.

Depth to the 2C horizon and free calcium carbonates ranges from 20 to 39 inches. The content of gravel ranges from 0 to 10 percent in the sandy material and from 0 to 3 percent in the clayey material. The content of cobbles ranges from 0 to 5 percent in the sandy material.

The Oa horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Texture is dominantly muck but the range includes sand, loamy sand, and the mucky analogues of those textures.

The Cg horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is sand.

The C horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 3 or 4. It is sand.

The 2C and 2Cg horizons have hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 to 4. Texture is silty clay or clay.

Winterfield Series

The Winterfield series consists of somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope ranges from 0 to 3 percent. The soils are classified as mixed, frigid Aquic Udipsamments.

Typical pedon of Winterfield loamy sand, 0 to 2 percent slopes, rarely flooded; 1,100 feet west and 500 feet south of the northeastern corner of sec. 32, T. 25 N., R. 7 W.; USGS Smithville topographic quadrangle; lat. 44 degrees 31 minutes 26 seconds N. and long. 85 degrees 10 minutes 45 seconds W.; Springfield Township:

A—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many fine and common medium roots; neutral; abrupt wavy boundary.

Bw1—7 to 11 inches; yellowish brown (10YR 5/6) sand; weak fine granular structure; very friable; few medium and fine roots; very dark gray (10YR 3/1) organic stains along root channnels; few medium distinct brownish yellow (10YR 6/8) masses of iron accumulation and many coarse distinct light brownish gray (10YR 6/2) masses of iron depletion with diffuse boundaries along root channels and on faces of peds; neutral; clear wavy boundary.

Bw2—11 to 18 inches; pale brown (10YR 6/3) sand; weak medium subangular blocky structure; very friable; few fine roots; few medium distinct yellowish brown (10YR 5/8) masses of iron accumulation with diffuse boundaries; neutral; abrupt wavy boundary.

Bw3—18 to 21 inches; brown (10YR 4/3) gravelly loamy sand; weak medium subangular blocky structure; very friable; very dark gray (10YR 3/1) organic stains throughout; few fine distinct yellowish brown (10YR 5/8) masses of iron accumulation with diffuse boundaries; 20 percent fine and medium gravel; slightly alkaline; abrupt wavy boundary.

C—21 to 80 inches; light brownish gray (10YR 6/2) sand; single grain; loose; many horizontal varves of very dark grayish brown (10YR 3/2) organic stains $^{1}/_{8}$ inch to 3 inches thick; about 1 percent fine gravel; slightly effervescent; slightly alkaline.

There is an irregular decrease in organic carbon throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is dominantly loamy sand but the range includes fine sand. The content of gravel ranges from 0 to 14 percent.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 4. It is sand, loamy sand, gravelly loamy sand, or gravelly sand. The content of gravel ranges from 0 to 20 percent.

The C horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4. It is sand. The content of gravel ranges from 0 to 14 percent.

Woodman Series

The Woodman series consists of moderately well drained soils on kame moraines. Permeability is moderately slow in the loamy material and rapid in the sandy material. These soils formed in loamy deposits over sandy deposits. Slope ranges from 1 to 12

percent. The soils are classified as fine-loamy, mixed, active, frigid Oxyaquic Glossudalfs.

Typical pedon of Woodman sandy loam in an area of Morganlake, sandy substratum-Woodman-Blue Lake complex, 1 to 6 percent slopes; 1,600 feet north and 1,350 feet west of the southeastern corner of sec. 30, T. 28 N., R. 8 W.; USGS Smithville topographic quadrangle; lat. 44 degrees 36 minutes 59 seconds N. and long. 85 degrees 12 minutes 7 seconds W.; Orange Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; common fine and medium roots; about 2 percent fine gravel; slightly acid; abrupt smooth boundary.

E/B—9 to 20 inches; pale brown (10YR 6/3) sandy loam (E part), light gray (10YR 7/2) dry; E part occupies about 80 percent of the horizon and is surrounded by brown (7.5YR 4/4) sandy clay loam (Bt part); moderate medium subangular blocky structure; firm; few fine and medium roots; many fine discontinous tubular pores; few medium distinct strong brown (7.5YR 4/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds in the lower part of the horizon; common very dark grayish brown (10YR 3/2) organic stains along worm and root channels; about 3 percent fine gravel; moderately acid; clear irregular boundary.

Bt—20 to 37 inches; brown (7.5YR 4/4) sandy clay loam; strong coarse subangular blocky structure; firm; few fine and medium roots; many fine discontinous tubular pores; many discontinuous dark brown (7.5YR 3/4) clay films on faces of peds; few medium faint strong brown (7.5YR 4/6) masses of iron accumulation with sharp boundaries along root channels and on faces of peds; few fine distinct yellowish brown (10YR 5/8) masses of iron accumulation with sharp boundaries along faces of peds; about 3 percent fine gravel; neutral; clear wavy boundary.

BC—37 to 45 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium subangular blocky structure; firm; few fine roots; many fine discontinous tubular pores; about 7 percent fine and medium gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C—45 to 56 inches; light brown (7.5YR 6/4) sandy loam; massive; firm; about 5 percent fine and medium gravel; many white (10YR 8/1) masses of calcium carbonate; violently effervescent; moderately alkaline; abrupt wavy boundary.

2E´ and Bt´—56 to 80 inches; light yellowish brown (10YR 6/4) sand (E part), light gray (10YR 7/2) dry; lamellae of brown (7.5YR 4/4) loamy sand (Bt part); single grain in E part; weak fine granular structure in Bt part; loose in E part and very friable in Bt part; clay bridging between sand grains; about 3 percent fine and medium gravel; strongly effervescent; moderately alkaline.

Depth to the 2E´ and Bt´ horizon ranges from 40 to 60 inches. Depth to redoximorphic concentrations ranges from 20 to 40 inches. The clay content of the argillic horizon averages 18 to 35 percent. The content of gravel ranges from 1 to 14 percent throughout the profile. The content of cobbles ranges from 0 to 3 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Texture is dominantly sandy loam but the range includes fine sandy loam and loam.

The E part of the E/B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam, fine sandy loam, or loam. The B part of the E/B horizon has textures and colors similar to those of the Bt horizon. The E/B horizon can have fragipan-like characteristics, such as hardness and brittleness when dry. A separate E horizon occurs in some pedons.

The Bt horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 3 or 4. It is sandy clay loam, silty clay loam, or clay loam. Base saturation is 60 percent or more.

The BC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam or sandy clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam, sandy clay loam, or silt loam. This horizon does not occur in some pedons.

The E part of the 2E´ and Bt´ horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. This part is sand. The Bt part of the 2E´ and Bt´ horizon occurs as lamellae 1/4 inch to 3 inches thick. This part has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand or sandy loam.

Formation of the Soils

This section relates the factors of soil formation to the soils in Kalkaska County and explains the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material *(12)*.

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Kalkaska County were deposited by glaciers or by glacial meltwater. Glaciers covered the county 10,000 to 12,000 years ago. Some of the materials have been reworked and redeposited by the subsequent action of wind and water. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Kalkaska County were deposited as ablation till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Ablation till was deposited by the downwasting of nearly stagnant glacial ice on the surface of the glacier. It is a mixture of particles of different sizes. The small pebbles in ablation till have sharp corners, indicating that they have not been worn by water. The ablation till in Kalkaska County is calcareous clay loam, sandy loam, and loamy sand. Southwells and Woodman soils are examples of soils that formed in ablation till.

Outwash material was deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the speed of the stream decreased, the coarser particles were deposited. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slow-moving water. Outwash deposits generally occur as layers of particles of similar size, such as loamy sand, sand, and gravel. Rubicon, Kalkaska, and Springlake soils are examples of soils that formed in deposits of outwash.

Lacustrine material was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of the moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. In Kalkaska County the soils that formed in lacustrine deposits typically are fine textured. Springport soils are an example.

Alluvium is material recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. Ausable and Bowstring soils are examples of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers receded, water was left standing in depressions on the outwash plains, on flood plains, and in ablation till areas. Because of the wetness, the grasses, sedges, and water-tolerant plants that grew around the edges of these depressions did not decompose quickly after they died. Eventually, the plant residue filled the depressions and decomposed to form muck. Lupton

soils are an example of soils that formed in organic material.

Plant and Animal Life

Native plants are the principle organisms that have influenced soil formation in Kalkaska County. The activities of micro-organisms, earthworms, and humans have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material in the soil depends on the kinds of plants that grew on the soil in the past. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria and earthworms in the soil help to break down the organic matter into plant nutrients.

More than 50 percent of the well drained sandy areas in Kalkaska County were dominated by coniferous trees, the rest of the areas had a mixed hardwood forest. Differences in the natural drainage and minor variations in the parent material affected the composition of the forest species. Well drained soils, such as Southwells, Blue Lake, Kalkaska, and Islandlake, were mainly covered by sugar maple, beech, and oak. Somewhat poorly drained and poorly drained soils were covered by northern white cedar, elm, ash, and red maple. These soils include Allendale, Au Gres, Springport, and Roscommon.

Climate

Climate determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and for the transporting of soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil. A thick snow cover throughout most winters prevents the soil from freezing. The warm summers cause moisture stress on plants growing on the sandy soils.

The climate is cool, humid, and generally uniform throughout the survey area. In low areas, frost may occur earlier in fall and later in spring.

Relief

Relief affects the natural drainage of soils, the rate of erosion, the kind of plant cover, and the soil temperature. Slopes range from 0 to 55 percent in Kalkaska County. Runoff is highest on the steeper slopes. In low areas water is temporarily ponded.

The soils in the county range from excessively drained on hilltops and ridgetops to very poorly drained in depressions. Through its effect on soil aeration, drainage partly determines the color of the soil. Water and air move freely through well drained soils and slowly through very poorly drained soils. In Kalkaska soils and other well aerated soils, the iron and aluminum compounds are brightly colored and oxidized. Roscommon soils and other poorly aerated soils are dull gray and mottled. Kalkaska and Roscommon soils formed in similar kinds of parent material. Soils that slope to the south are generally drier and warmer than those on north-facing slopes.

Time

Generally, a long time is needed for the development of distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly. The soils in Kalkaska County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the development of distinct horizons. The soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct soil horizons. Ausable soils are an example of young alluvial soils. Kalkaska soils are an example of mature soils.

Processes of Soil Formation

The processes responsible for the development of soil horizons in the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the horizons are referred to as soil morphology.

Several processes were involved in the development of horizons in the soils of Kalkaska County—the accumulation of organic matter; the leaching of iron, aluminum, carbon, and lime (calcium carbonate); and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of horizons.

As organic matter accumulates at the surface of a soil, an A horizon forms. If the soil is plowed, this horizon is mixed into a plow layer, or Ap horizon. In the soils in Kalkaska County, the surface layer ranges from high to low in content of organic matter. Leafriver

soils are an example of soils that have a high content of organic matter in the surface layer. Rubicon soils are an example of soils that have a low content of organic matter.

The leaching of carbonates and other bases has occurred in most of the soils. The leaching of bases generally precedes the translocation of carbon, iron, aluminum, and silicate clay minerals. Many of the soils in Kalkaska County are moderately leached or strongly leached. For example, Southwells soils are leached of carbonates to a depth of more than 40 inches and Springport soils are leached to a depth of 20 to 40 inches. The difference in the depth of leaching is a result of relief and parent material.

Redoximorphic features, such as iron depletions and iron accumulations, are caused by the reduction, or oxidation, of iron. Redoximorphic features are evident in moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained soils. A gray subsoil indicates the reduction or loss of iron due to a permanent high water table. Roscommon and Leafriver soils are examples of iron-depleted soils. A subsoil with bright-colored blotches (mottles), such as the subsoil of Au Gres and Croswell soils, indicates oxidation or an accumulation of iron due to a seasonally fluctuating water table.

The translocation of clay and other minerals contributes to horizon development. An eluviated, or leached, E horizon typically has a lower content of clay, carbon, iron, and aluminum than the illuviated B horizon and typically is lighter in color. The B horizon typically has an accumulation of clay, carbon, iron, or aluminum on sand grains, in pores, or on the faces of peds. Soils at this stage of formation probably were leached of carbonates and soluble salts to a considerable extent before the silicate clays were translocated. Islandlake and Negwegon soils are examples.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial cone. The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Backslopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bogs. Waterlogged, spongy ground, consisting primarily of acidic vegetation. These usually occur in small closed depressional areas within mineral units.

Borrow pit. An open excavation from which soil and underlying material have been removed, usually for road construction.

Bottom land. The normal flood plain of a stream, subject to flooding.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cut and fill. Areas where native soil has been removed or buried.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression. A shallow, saucer-shaped area slightly lower on the landscape that the surrounding area, but without a natural outlet for surface drainage.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Escarpment. A relatively continuous and steep slope or cliff produced by erosion or faulting breaking the general continuity of more gently sloping land surfaces.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has

drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Footslope. The inclined surface at the base of a hill.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel spot. An area where the surface layer has more than 35 percent, by volume, of rock fragments that are mostly less than 3 inches in diameter.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravel strata. Areas that have gravel strata in the subsoil.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A

horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. A method of irrigation in the survey area is sprinkler—water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Kame moraine. A group of kames along the front of a stagnant glacier, commonly comprising the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loam at depth. Areas where loamy material is between 20 to 40 inches in sandy units.

Loamy spot. Sandy areas where loamy material is at the surface.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Marl spot. Areas where the surface layer is organic marl deposits surrounded by mineral or organic muck.

Marsh. A water-saturated, very poorly drained area, intermittently or permanently covered by water. Marsh areas are dominantly covered by sedges, cattails, and rushes. Term not used for map units where poorly drained or very poorly drained soils are the named components.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Mineral spot. An area of mineral soils in an organic area.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Organic spot. A non-acid area of organic soil more than 9 inches thick surrounded by mineral surface texture.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Perennial stream. A stream or reach of a stream that

flows continuously throughout the year and whose surface is generally lower than the water table adjacent to the region adjoining the stream.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pits, gravel. An open excavation from which soil and underlying material have been removed for use as a source of sand or gravel.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the

chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Relief. The elevations or inequalities of a land surface, considered collectively.

Remnant moraines. Deposits of glacial drift that have been subsequently eroded, dissected, or channelized into discrete segments which have shallow or discontinuous remnants of the original moraine. These moraines were deposited during an older glacial period and remain after subsequent glacial advances.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments ranging from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy spot. An area with a sandy surface layer where the surface layer is typically loamy or finer.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot. An area where the surface layer has been removed due to erosion.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short steep slope. A narrow soil area that has slopes that are at least 2 slope classes steeper than the slope class of the surrounding map unit.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees

in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Level	0 to 2 percent
Nearly level	0 to 3 percent
Gently sloping	2 to 6 percent
Moderately sloping	6 to 12 percent
Strongly sloping	12 to 18 percent
Moderately steep	12 to 25 percent
Steep	18 to 35 percent
Very steep	35 percent and higher

Classes for complex slopes are as follows:

Level	0 to 2 percent
Nearly level	0 to 3 percent
Gently undulating	0 to 4 percent
Undulating	2 to 6 percent
Gently rolling	6 to 12 percent
Rolling	6 to 18 percent
Hilly	12 to 18 percent
Steep	18 to 35 percent
Very steep	35 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spring. A specific site where ground water flows from the surface for at least 6 months of the year.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot. An area where .01 to 3 percent of the surface is covered with rock fragments that are greater than 10 inches in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where

annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot. A somewhat poorly drained to very poorly drained area that is at least 2 drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

Table 1A.—Temperature and Precipitation

(Recorded in the period 1961-90 at Lake City, Michigan)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January--	25.7	8.5	17.1	47	-22	0	1.38	0.81	1.89	4	19.8
February-	28.7	7.6	18.2	49	-24	0	1.13	0.61	1.60	3	14.9
March----	38.6	17.3	27.9	66	-17	22	1.87	1.02	2.62	5	11.9
April----	53.4	30.7	42.0	81	8	150	2.64	1.68	3.50	6	4.0
May------	66.8	40.4	53.6	86	22	426	2.68	1.44	3.77	6	0.2
June-----	75.8	49.2	62.5	93	30	672	3.00	1.43	4.35	6	0.0
July-----	80.8	53.9	67.3	94	36	842	2.55	1.41	3.57	5	0.0
August---	77.5	52.1	64.8	92	34	764	3.40	1.74	4.84	6	0.0
September	69.1	45.1	57.1	86	26	511	3.95	1.81	5.79	7	0.0
October--	56.9	35.7	46.3	80	19	226	2.78	1.73	3.74	7	1.0
November-	42.7	26.8	34.7	68	2	46	2.58	1.44	3.58	6	8.6
December-	30.0	14.8	22.4	54	-15	4	1.89	1.20	2.52	5	15.2
Yearly:											
Average-	53.8	31.8	42.8	---	---	---	---	---	---	---	---
Extreme-	---	---	---	95	-25	---	---	---	---	---	---
Total---	---	---	---	---	---	3,662	29.86	26.04	32.82	66	75.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 1B.—Temperature and Precipitation

(Recorded in the period 1961-90 at Grayling, Michigan)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January--	25.9	9.3	17.6	48	-23	0	1.70	1.13	2.21	6	24.0
February-	28.4	7.6	18.0	49	-26	0	1.36	0.68	1.95	5	16.3
March----	38.2	16.5	27.4	64	-16	2	1.85	1.03	2.58	5	14.7
April----	54.1	30.3	42.2	82	6	47	2.71	1.55	3.72	7	4.6
May------	67.9	40.5	54.2	89	22	204	3.03	1.92	4.02	7	0.4
June-----	76.8	49.9	63.4	93	30	412	3.38	1.67	4.87	7	0.0
July-----	80.9	54.1	67.5	95	38	550	2.59	1.97	5.02	6	0.0
August---	78.6	52.7	65.7	94	35	493	3.48	1.84	4.92	7	0.0
September	69.6	45.9	57.8	90	27	260	3.61	1.84	5.14	8	0.0
October--	58.4	35.1	47.8	81	18	92	2.68	1.48	3.74	7	0.9
November-	42.9	27.4	35.2	68	0	8	2.67	1.70	3.55	7	11.9
December-	30.4	15.3	22.9	55	-16	**	1.89	1.19	2.52	6	20.1
Yearly:											
Average-	54.3	32.2	43.3	---	---	---	---	---	---	---	---
Extreme-	---	---	---	96	-27	---	---	---	---	---	---
Total---	---	---	---	---	---	2,068	31.95	27.85	35.91	78	92.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

** Less than 0.5.

Table 2A.—Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Lake City, Michigan)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 14	May 28	June 21
2 years in 10 later than--	May 8	May 22	June 14
5 years in 10 later than--	Apr. 28	May 12	June 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 1	Sept. 14	Aug. 28
2 years in 10 earlier than--	Oct. 8	Sept. 19	Sept. 3
5 years in 10 earlier than--	Oct. 20	Sept. 30	Sept. 14

Table 2B.—Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Grayling, Michigan)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 17	May 31	June 17
2 years in 10 later than--	May 11	May 25	June 11
5 years in 10 later than--	Apr. 30	May 15	May 30
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 2	Sept. 17	Aug. 30
2 years in 10 earlier than--	Oct. 9	Sept. 23	Sept. 5
5 years in 10 earlier than--	Oct. 21	Oct. 4	Sept. 17

Table 3A.—Growing Season

(Recorded in the period 1961-90 at Lake City, Michigan)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	150	118	80
8 years in 10	159	125	88
5 years in 10	175	141	104
2 years in 10	191	156	120
1 year in 10	199	163	129

Table 3B.—Growing Season

(Recorded in the period 1961-90 at Grayling, Michigan)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	152	117	82
8 years in 10	159	125	92
5 years in 10	174	141	110
2 years in 10	188	157	128
1 year in 10	196	165	138

Table 4.—Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
13	Tawas-Lupton mucks	15,125	4.1
14	Dawson-Loxley peats	2,079	0.6
15A	Croswell-Au Gres sands, 0 to 3 percent slopes	2,907	0.8
16B	Graycalm sand, 0 to 6 percent slopes	5,392	1.5
16E	Graycalm sand, 18 to 35 percent slopes	204	*
17A	Croswell sand, 0 to 3 percent slopes	17,288	4.7
18A	Au Gres sand, 0 to 3 percent slopes	6,381	1.7
19	Leafriver muck	1,261	0.3
20B	Graycalm-Grayling sands, 0 to 6 percent slopes	2,192	0.6
20D	Graycalm-Grayling sands, 6 to 18 percent slopes	1,261	0.3
20F	Graycalm-Grayling sands, 18 to 45 percent slopes	638	0.2
21B	Graycalm-Klacking complex, 0 to 6 percent slopes	7,217	2.0
21D	Graycalm-Klacking complex, 6 to 18 percent slopes	1,050	0.3
21F	Graycalm-Klacking complex, 18 to 45 percent slopes	229	*
22B	Montcalm loamy sand, 0 to 6 percent slopes	415	0.1
23	Ausable-Bowstring mucks, frequently flooded	9,457	2.6
24A	Kinross-Au Gres complex, 0 to 3 percent slopes	1,511	0.4
26B	Cublake sand, 0 to 6 percent slopes	1,128	0.3
28B	East Lake sand, 0 to 6 percent slopes	1,001	0.3
32B	Kellogg sand, 0 to 6 percent slopes	742	0.2
35	Kinross muck	1,085	0.3
47D	Graycalm sand, 6 to 18 percent slopes	486	0.1
48B	Rubicon-Graycalm sands, 0 to 6 percent slopes	2,385	0.7
48D	Rubicon-Graycalm sands, 6 to 18 percent slopes	1,570	0.4
48E	Rubicon-Graycalm sands, 18 to 35 percent slopes	1,391	0.4
49B	Kalkaska sand, 0 to 6 percent slopes	25,360	6.9
49B3	Kalkaska sand, 0 to 6 percent slopes, severely flooded	323	*
49C	Kalkaska sand, 6 to 12 percent slopes	2,967	0.8
49D	Kalkaska sand, 12 to 18 percent slopes	2,639	0.7
49E	Kalkaska sand, 18 to 35 percent slopes	3,113	0.9
50B	Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes	905	0.2
51	Tawas-Leafriver mucks	10,183	2.8
53B	Negwegon silt loam, 2 to 6 percent slopes	282	*
53C	Negwegon silt loam, 6 to 12 percent slopes	94	*
54A	Algonquin silt loam, 0 to 3 percent slopes	418	0.1
58A	Wakeley-Allendale complex, 0 to 3 percent slopes	1,499	0.4
75B	Rubicon sand, 0 to 6 percent slopes	46,857	12.8
75D	Rubicon sand, 6 to 18 percent slopes	5,777	1.6
75E	Rubicon sand, 18 to 35 percent slopes	2,982	0.8
78	Pits, borrow	224	*
81B	Grayling sand, 0 to 6 percent slopes	14,177	3.9
81D	Grayling sand, 6 to 18 percent slopes	2,296	0.6
81E	Grayling sand, 18 to 35 percent slopes	1,363	0.4
81F	Grayling sand, 18 to 45 percent slopes	35	*
83B	Udipsamments, nearly level and undulating	157	*
83F	Udipsamments, nearly level to very steep	396	0.1
86	Histosols and Aquents, ponded	2,379	0.7
87	Ausable muck, frequently flooded	620	0.2
99	Roscommon mucky sand	1,910	0.5
131E	Rubicon-Menominee sands, 18 to 35 percent slopes	449	0.1
147B	Lindquist sand, 0 to 6 percent slopes	4,177	1.1
147C	Lindquist sand, 6 to 12 percent slopes	1,628	0.4
147D	Lindquist sand, 12 to 18 percent slopes	1,294	0.4
147E	Lindquist sand, 18 to 35 percent slopes	614	0.2
159A	Finch sand, 0 to 3 percent slopes	866	0.2
174A	Au Gres-Roscommon complex, 0 to 3 percent slopes	3,541	1.0
197A	Gladwin loamy sand, 0 to 3 percent slopes	281	*
338B	Islandlake sand, 0 to 6 percent slopes	13,997	3.8
338C	Islandlake sand, 6 to 12 percent slopes	6,759	1.9
338D	Islandlake sand, 12 to 18 percent slopes	8,458	2.3

See footnote at end of table.

Table 4.—Acreage and Proportionate Extent of the Soils—Continued

Map symbol	Soil name	Acres	Percent
338E	Islandlake sand, 18 to 35 percent slopes	7,221	2.0
360	Wakeley muck	682	0.2
366B	Islandlake-Blue Lake complex, 0 to 6 percent slopes	10,785	3.0
366C	Islandlake-Blue Lake complex, 6 to 12 percent slopes	5,062	1.4
366D	Islandlake-Blue Lake complex, 12 to 18 percent slopes	3,313	0.9
366E	Islandlake-Blue Lake complex, 18 to 35 percent slopes	1,618	0.4
371	Springport silt loam	417	0.1
380	Access denied	265	*
402B	Islandlake loamy sand, 0 to 6 percent slopes	30,970	8.5
402C	Islandlake loamy sand, 6 to 12 percent slopes	1,003	0.3
406A	Winterfield loamy sand, 0 to 2 percent slopes, rarely flooded	152	*
412A	Ingalls-Burleigh loamy sands, 0 to 3 percent slopes	694	0.2
454B	Springlake sand, 0 to 6 percent slopes	7,597	2.1
454C	Springlake sand, 6 to 12 percent slopes	670	0.2
454D	Springlake sand, 12 to 18 percent slopes	299	*
454E	Springlake sand, 18 to 35 percent slopes	708	0.2
457B	Islandlake-Southwells complex, 0 to 6 percent slopes	5,106	1.4
457C	Islandlake-Southwells complex, 6 to 12 percent slopes	3,958	1.1
457D	Islandlake-Southwells complex, 12 to 18 percent slopes	2,908	0.8
457E	Islandlake-Southwells complex, 18 to 35 percent slopes	1,462	0.4
458D	Islandlake-Menominee sands, 12 to 18 percent slopes	331	*
459B	Rubicon sand, calcareous substratum, 0 to 6 percent slopes	1,154	0.3
459D	Rubicon sand, calcareous substratum, 6 to 18 percent slopes	1,199	0.3
459E	Rubicon sand, calcareous substratum, 18 to 35 percent slopes	481	0.1
460B	Rubicon, calcareous substratum-Mancelona sands, 0 to 6 percent slopes	1,620	0.4
460C	Rubicon, calcareous substratum-Mancelona sands, 6 to 12 percent slopes	453	0.1
460D	Rubicon, calcareous substratum-Mancelona sands, 12 to 18 percent slopes	463	0.1
460E	Rubicon, calcareous substratum-Mancelona sands, 18 to 35 percent slopes	740	0.2
460F	Rubicon, calcareous substratum-Mancelona sands, 35 to 55 percent slopes	297	*
461A	Allendale-Springport complex, 0 to 3 percent slopes	348	*
462A	Allendale-Algonquin complex, 0 to 3 percent slopes	1,183	0.3
466B	Halfaday loamy sand, 0 to 4 percent slopes	2,486	0.7
467B	Morganlake, sandy substratum-Woodman-Blue Lake complex, 1 to 6 percent slopes	2,536	0.7
467C	Morganlake, sandy substratum-Woodman-Blue Lake complex, 6 to 12 percent slopes	1,144	0.3
468F	Southwells-Mancelona-Dighton complex, 8 to 50 percent slopes, dissected	3,326	0.9
469B	Hodenpyl-Montcalm complex, 0 to 6 percent slopes	1,450	0.4
471B	Mancelona-Blue Lake complex, 0 to 6 percent slopes	277	*
472B	Morganlake loamy sand, sandy substratum, 0 to 6 percent slopes	289	*
488A	Allendale sand, 0 to 3 percent slopes	264	*
494	Gauld fine sandy loam	90	*
W	Water	6,595	1.8
	Total	365,031	100.0

* Less than 0.1 percent.

Table 5.—Land Capability and Yields Per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. They are for non-irrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. "Cwt" indicates 100 pounds per acre)

Map symbol and soil name	Land capability	Snap beans	Corn	Corn silage	Oats	Irish potatoes	Alfalfa hay	Winter wheat
			Bu	Tons	Bu	Cwt	Tons	Bu
13:								
Tawas----------	6w	---	---	---	---	---	---	---
Lupton---------	6w	---	---	---	---	---	---	---
14:								
Dawson---------	7w	---	---	---	---	---	---	---
Loxley---------	7w	---	---	---	---	---	---	---
15A:								
Croswell--------	4s	---	50.0	9.0	50.0	---	2.5	25.0
Au Gres---------	4w	---	55.0	10.0	45.0	---	---	25.0
16B:								
Graycalm--------	4s	---	---	---	---	---	---	---
16E:								
Graycalm--------	7s	---	---	---	---	---	---	---
17A:								
Croswell--------	4s	---	50.0	9.0	50.0	---	2.5	25.0
18A:								
Au Gres---------	4w	---	55.0	10.0	45.0	---	---	25.0
19:								
Leafriver-------	6w	---	---	---	---	---	---	---
20B:								
Graycalm--------	4s	---	---	---	---	---	---	---
Grayling--------	6s	---	---	---	---	---	---	---
20D:								
Graycalm--------	6s	---	---	---	---	---	---	---
Grayling--------	7s	---	---	---	---	---	---	---
20F:								
Graycalm--------	7s	---	---	---	---	---	---	---
Grayling--------	7s	---	---	---	---	---	---	---
21B:								
Graycalm--------	4s	---	---	---	---	---	---	---
Klacking--------	3s	---	---	---	---	---	---	---
21D:								
Graycalm--------	6s	---	---	---	---	---	---	---
Klacking--------	4e	---	---	---	---	---	---	---
21F:								
Graycalm--------	7s	---	---	---	---	---	---	---
Klacking--------	7e	---	---	---	---	---	---	---
22B:								
Montcalm--------	3s	---	70.0	12.0	60.0	---	3.0	28.0

Table 5.—Land Capability and Yields Per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Snap beans	Corn	Corn silage	Oats	Irish potatoes	Alfalfa hay	Winter wheat
			Bu	Tons	Bu	Cwt	Tons	Bu
23:								
Ausable----------	7w	---	---	---	---	---	---	---
Bowstring--------	6w	---	---	---	---	---	---	---
24A:								
Kinross----------	6w	---	---	---	---	---	---	---
Au Gres----------	4w	---	---	---	---	---	---	---
26B:								
Cublake----------	4s	---	50.0	8.0	50.0	---	---	25.0
28B:								
East Lake--------	4s	---	50.0	9.0	40.0	---	2.5	---
32B:								
Kellogg----------	3s	---	75.0	12.0	70.0	---	3.5	35.0
35:								
Kinross----------	6w	---	---	---	---	---	---	---
47D:								
Graycalm---------	6s	---	---	---	---	---	---	---
48B:								
Rubicon----------	6s	---	---	---	---	---	2.0	---
Graycalm---------	4s	---	---	---	---	---	---	---
48D:								
Rubicon----------	7s	---	---	---	---	---	---	---
Graycalm---------	6s	---	---	---	---	---	---	---
48E:								
Rubicon----------	7s	---	---	---	---	---	---	---
Graycalm---------	7s	---	---	---	---	---	---	---
49B:								
Kalkaska---------	4s	---	50.0	9.0	40.0	250.0	2.5	25.0
49B3:								
Kalkaska---------	6s	---	---	---	---	---	---	---
49C:								
Kalkaska---------	6s	---	50.0	9.0	40.0	---	2.0	25.0
49D:								
Kalkaska---------	6s	---	---	---	---	---	2.0	---
49E:								
Kalkaska---------	7s	---	---	---	---	---	---	---
50B:								
Au Gres----------	4w	---	55.0	10.0	45.0	---	---	25.0
Kinross----------	6w	---	---	---	---	---	---	---
Croswell---------	4s	---	50.0	9.0	50.0	---	2.5	25.0
51:								
Tawas------------	6w	---	---	---	---	---	---	---
Leafriver--------	6w	---	---	---	---	---	---	---

Table 5.—Land Capability and Yields Per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Snap beans	Corn	Corn silage	Oats	Irish potatoes	Alfalfa hay	Winter wheat
			Bu	Tons	Bu	Cwt	Tons	Bu
53B:								
Negwegon--------	3e	---	75.0	12.0	70.0	---	3.5	---
53C:								
Negwegon--------	3e	---	68.0	10.0	65.0	---	3.1	---
54A:								
Algonquin-------	3w	---	80.0	13.0	75.0	---	3.5	---
58A:								
Wakeley---------	5w	---	---	---	---	---	---	---
Allendale-------	3w	---	---	---	---	---	---	---
75B:								
Rubicon---------	6s	---	---	---	---	---	2.0	---
75D, 75E:								
Rubicon---------	7s	---	---	---	---	---	---	---
78.								
Pits, borrow								
81B:								
Grayling--------	6s	---	---	---	---	---	---	---
81D, 81E, 81F:								
Grayling--------	7s	---	---	---	---	---	---	---
83B, 83F.								
Udipsamments								
86:								
Histosols-------	5w	---	---	---	---	---	---	---
Aquents---------	6w	---	---	---	---	---	---	---
87:								
Ausable---------	7w	---	---	---	---	---	---	---
99:								
Roscommon-------	6w	---	---	---	---	---	---	---
131E:								
Rubicon---------	7s	---	---	---	---	---	---	---
Menominee-------	7e	---	---	---	---	---	---	---
147B:								
Lindquist-------	4s	---	50.0	9.0	40.0	---	2.5	40.0
147C, 147D:								
Lindquist-------	6s	---	---	---	---	---	2.3	---
147E:								
Lindquist-------	7s	---	---	---	---	---	2.3	---
159A:								
Finch-----------	4w	---	45.0	9.0	40.0	---	---	22.0

Table 5.—Land Capability and Yields Per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Snap beans	Corn	Corn silage	Oats	Irish potatoes	Alfalfa hay	Winter wheat
			Bu	Tons	Bu	Cwt	Tons	Bu
174A:								
Au Gres---------	4w	---	---	---	---	---	---	---
Roscommon-------	6w	---	---	---	---	---	---	---
197A:								
Gladwin---------	3w	---	86.0	9.0	50.0	---	3.0	32.0
338B:								
Islandlake------	4s	---	50.0	9.0	40.0	---	2.5	20.0
338C:								
Islandlake------	6s	---	50.0	9.0	40.0	---	2.5	20.0
338D, 338E:								
Islandlake------	7s	---	---	---	---	---	---	---
360:								
Wakeley---------	5w	---	---	---	---	---	---	---
366B:								
Islandlake------	4s	---	50.0	9.0	40.0	---	2.5	20.0
Blue Lake-------	3s	---	70.0	11.0	60.0	---	3.0	28.0
366C:								
Islandlake------	6s	---	50.0	9.0	40.0	---	2.5	20.0
Blue Lake-------	3s	---	70.0	11.0	60.0	---	3.0	28.0
366D:								
Islandlake------	6s	---	---	---	---	---	---	---
Blue Lake-------	3s	---	---	---	---	---	---	---
366E:								
Islandlake------	7s	---	---	---	---	---	---	---
Blue Lake-------	3s	---	---	---	---	---	---	---
371:								
Springport------	5w	---	---	---	---	---	---	---
380.								
Access denied								
402B:								
Islandlake------	3s	25.0	65.0	12.0	55.0	285.0	28.0	28.0
402C:								
Islandlake------	3e	25.0	65.0	12.0	55.0	285.0	26.0	26.0
406A:								
Winterfield-----	4w	---	---	---	---	---	---	---
412A:								
Ingalls---------	3w	---	85.0	14.0	75.0	---	3.5	40.0
Burleigh--------	5w	---	---	---	---	---	---	---
454B:								
Springlake------	4s	---	57.0	7.7	32.0	162.0	2.6	---
454C:								
Springlake------	6s	---	57.0	7.7	32.0	162.0	2.6	---

Table 5.—Land Capability and Yields Per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Snap beans	Corn	Corn silage	Oats	Irish potatoes	Alfalfa hay	Winter wheat
			Bu	Tons	Bu	Cwt	Tons	Bu
454D:								
Springlake------	6s	---	---	---	---	---	---	---
454E:								
Springlake------	7s	---	---	---	---	---	---	---
457B:								
Islandlake------	4s	---	50.0	9.0	40.0	---	2.5	20.0
Southwells------	3e	---	70.0	11.0	60.0	---	3.0	28.0
457C:								
Islandlake------	6s	---	43.0	7.0	35.0	---	2.0	17.0
Southwells------	3e	---	63.0	10.0	54.0	---	2.3	25.0
457D:								
Islandlake------	7s	---	---	---	---	---	---	---
Southwells------	4e	---	---	---	---	---	---	---
457E:								
Islandlake------	7s	---	---	---	---	---	---	---
Southwells------	7e	---	---	---	---	---	---	---
458D:								
Islandlake------	7s	---	---	---	---	---	---	---
Menominee-------	4e	---	---	---	---	---	---	---
459B, 459D:								
Rubicon---------	6s	---	---	---	---	---	---	---
459E:								
Rubicon---------	7s	---	---	---	---	---	---	---
460B:								
Rubicon---------	6s	---	---	---	---	---	---	---
Mancelona-------	3s	---	---	---	---	---	---	---
460C:								
Rubicon---------	6s	---	---	---	---	---	---	---
Mancelona-------	3e	---	---	---	---	---	---	---
460D:								
Rubicon---------	7s	---	---	---	---	---	---	---
Mancelona-------	4e	---	---	---	---	---	---	---
460E, 460F:								
Rubicon---------	7s	---	---	---	---	---	---	---
Mancelona-------	7e	---	---	---	---	---	---	---
461A:								
Allendale-------	3w	---	85.0	14.0	75.0	---	3.5	40.0
Springport------	5w	---	---	---	---	---	---	---
462A:								
Allendale-------	3w	---	85.0	14.0	75.0	---	3.5	40.0
Algonquin-------	3w	---	80.0	13.0	75.0	---	3.5	30.0
466B:								
Halfaday--------	3s	---	50.0	9.0	50.0	---	2.5	---

Table 5.—Land Capability and Yields Per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Snap beans	Corn	Corn silage	Oats	Irish potatoes	Alfalfa hay	Winter wheat
			Bu	Tons	Bu	Cwt	Tons	Bu
467B:								
Morganlake------	3s	---	75.0	13.0	70.0	---	3.5	35.0
Woodman---------	3e	---	90.0	14.0	80.0	---	3.7	45.0
Blue Lake-------	3s	---	70.0	11.0	60.0	---	3.0	28.0
467C:								
Morganlake------	3e	---	65.0	12.0	65.0	---	3.3	30.0
Woodman---------	3e	---	80.0	14.0	75.0	---	3.5	40.0
Blue Lake-------	3e	---	70.0	11.0	60.0	---	3.0	28.0
468F:								
Southwells------	7e	---	---	---	---	---	---	---
Mancelona-------	7e	---	---	---	---	---	---	---
Dighton---------	7e	---	---	---	---	---	---	---
469B:								
Hodenpyl--------	2e	---	75.0	12.0	75.0	---	3.3	35.0
Montcalm--------	3s	---	70.0	12.0	60.0	---	3.0	28.0
471B:								
Mancelona-------	3s	---	65.0	11.0	55.0	---	2.6	28.0
Blue Lake-------	3s	---	70.0	11.0	60.0	---	3.0	28.0
472B:								
Morganlake------	3s	---	75.0	12.0	70.0	---	3.5	35.0
488A:								
Allendale-------	3w	---	85.0	14.0	75.0	---	3.5	40.0
494:								
Gauld-----------	5w	---	---	---	---	---	---	---
W.								
Water								

Table 6.—Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
32B	Kellogg sand, 0 to 6 percent slopes
53B	Negwegon silt loam, 2 to 6 percent slopes
54A	Algonquin silt loam, 0 to 3 percent slopes (where drained)
462A	Allendale-Algonquin complex, 0 to 3 percent slopes (where drained)
467B	Morganlake, sandy substratum-Woodman-Blue Lake complex, 1 to 6 percent slopes
472B	Morganlake loamy sand, sandy substratum, 0 to 6 percent slopes
469B	Hodenpyl-Montcalm complex, 0 to 6 percent slopes
494	Gauld fine sandy loam (where drained)

Table 7.—Woodland Management and Productivity

(Absence of an entry indicates that information was not available)

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
13:										
Tawas-----------	5W	Slight	Severe	Severe	Severe	Severe	Red maple-----------	---	---	---
							Balsam fir----------	40	5	
							Black ash-----------	---	---	
							Eastern hemlock-----	---	---	
							Northern white-cedar	---	---	
Lupton----------	2W	Slight	Severe	Severe	Severe	Severe	Red maple-----------	---	---	---
							Paper birch---------	---	---	
							Balsam fir----------	46	6	
							Black ash-----------	---	---	
							Northern white-cedar	---	---	
							Tamarack------------	---	---	
							Yellow birch--------	---	---	
							Black spruce--------	20	2	
14:										
Dawson----------	2W	Slight	Severe	Severe	Severe	Severe	Tamarack------------	---	---	---
							Black spruce--------	15	2	
							Eastern white pine--	---	---	
Loxley----------	2W	Slight	Severe	Severe	Severe	Severe	Jack pine-----------	---	---	---
							Tamarack------------	---	---	
							Black spruce--------	15	2	
15A:										
Croswell--------	5S	Slight	Moderate	Moderate	Moderate	Moderate	Paper birch---------	54	4	White spruce, red pine, eastern white pine
							Jack pine-----------	53	5	
							Red pine------------	55	6	
							Red maple-----------	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Bigtooth aspen------	69	6	
							Quaking aspen-------	68	5	
							Black cherry--------	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
15A:										
Au Gres	6W	Slight	Severe	Moderate	Severe	Severe	Red maple	65	3	Norway spruce, white spruce, red pine, eastern white pine
							Yellow birch	---	---	
							Paper birch	---	---	
							Balsam fir	---	---	
							Eastern white pine	---	---	
							Eastern hemlock	---	---	
							Bigtooth aspen	---	---	
							Quaking aspen	70	6	
							Northern white-cedar	---	---	
16B:										
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							White oak	---	---	
16E:										
Graycalm	6R	Moderate	Moderate	Moderate	Slight	Slight	White oak	---	---	Red pine, eastern white pine
							Paper birch	---	---	
							Jack pine	56	6	
							Red maple	---	---	
							Red pine	61	7	
							Northern red oak	62	4	
							Eastern white pine	---	---	
							Bigtooth aspen	70	6	
							Quaking aspen	60	4	
17A:										
Croswell	5S	Slight	Moderate	Moderate	Moderate	Moderate	Paper birch	54	4	White spruce, red pine, eastern white pine
							Jack pine	53	5	
							Red pine	55	6	
							Red maple	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Bigtooth aspen	69	6	
							Quaking aspen	68	5	
							Black cherry	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
18A:										
Au Gres----------	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	65	3	Norway spruce,
							Yellow birch--------	---	---	white spruce,
							Paper birch---------	---	---	red pine,
							Balsam fir----------	---	---	eastern white
							Eastern white pine--	---	---	pine
							Eastern hemlock-----	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	70	6	
							Northern white-cedar	---	---	
19:										
Leafriver-------	2W	Slight	Severe	Severe	Severe	Severe	Paper birch---------	---	---	Black ash,
							Black ash-----------	55	2	tamarack,
							Black spruce--------	---	---	black spruce
							Northern white-cedar	---	---	
							Red maple-----------	---	---	
20B, 20D:										
Graycalm--------	6S	Slight	Moderate	Moderate	Slight	Slight	Jack pine-----------	56	6	Red pine,
							Red pine------------	61	7	eastern white
							Eastern white pine--	---	---	pine
							Paper birch---------	---	---	
							Bigtooth aspen------	70	6	
							Red maple-----------	---	---	
							Quaking aspen-------	60	4	
							Northern red oak----	62	4	
							White oak-----------	---	---	
Grayling--------	4S	Slight	Moderate	Moderate	Slight	Slight	Red pine------------	---	---	Jack pine, red
							Jack pine-----------	48	4	pine
							Quaking aspen-------	---	---	
							Red maple-----------	---	---	
							Bigtooth aspen------	---	---	
							Northern pin oak----	43	2	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
20F:										
Graycalm	6R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							White oak	---	---	
Grayling	4R	Moderate	Moderate	Moderate	Slight	Slight	Red pine	---	---	Jack pine, red pine
							Jack pine	48	4	
							Quaking aspen	---	---	
							Red maple	---	---	
							Bigtooth aspen	---	---	
							Northern pin oak	43	2	
21B, 21D:										
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							White oak	---	---	
Klacking	6S	Slight	Slight	Slight	Slight	Slight	Jack pine	---	---	Red pine, eastern white pine
							Red pine	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	---	---	
							Northern red oak	60	4	
							Black cherry	---	---	
							White oak	57	3	
							Northern pin oak	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
21F:										
Graycalm	6R	Moderate	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Red pine, eastern white pine
							Red maple	---	---	
							Jack pine	56	6	
							White oak	---	---	
							Red pine	61	7	
							Eastern white pine	---	---	
							Bigtooth aspen	70	6	
							Quaking aspen	60	4	
							Northern red oak	62	4	
Klacking	6R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine	---	---	Red pine, eastern white pine
							Red maple	---	---	
							Bigtooth aspen	70	6	
							Northern red oak	60	4	
							Black cherry	---	---	
							White oak	57	3	
22B:										
Montcalm	3A	Slight	Slight	Slight	Slight	Moderate	Eastern hophornbeam	---	---	White spruce, red pine
							Red maple	---	---	
							Sugar maple	61	3	
							American basswood	---	---	
							Paper birch	---	---	
							Northern red oak	66	3	
							Red pine	---	---	
							Bigtooth aspen	---	---	
							Quaking aspen	---	---	
23:										
Ausable	2W	Slight	Severe	Severe	Severe	Severe	Paper birch	---	---	---
							Black ash	---	---	
							Northern white-cedar	15	2	
							Balsam poplar	---	---	
Bowstring	3W	Slight	Severe	Severe	Severe	Severe	Balsam fir	---	---	---
							Red maple	---	---	
							Northern white-cedar	15	3	
							Black ash	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
24A:										
Kinross----------	2W	Slight	Severe	Severe	Severe	Severe	Tamarack------------	---	---	---
							Red maple-----------	---	---	
							Black spruce--------	---	---	
							Quaking aspen-------	45	2	
							Eastern white pine--	---	---	
Au Gres----------	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	65	3	Norway spruce, white spruce, red pine, eastern white pine
							Yellow birch--------	---	---	
							Paper birch---------	---	---	
							Balsam fir----------	---	---	
							Eastern white pine--	---	---	
							Eastern hemlock-----	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	70	6	
							Northern white-cedar	---	---	
26B:										
Cublake----------	7A	Slight	Slight	Slight	Slight	Moderate	Red maple-----------	---	---	Jack pine, red pine, eastern white pine
							Paper birch---------	---	---	
							Balsam fir----------	---	---	
							Red pine------------	60	7	
							Northern red oak----	---	---	
							Eastern white pine--	---	---	
							Quaking aspen-------	---	---	
28B:										
East Lake--------	2S	Slight	Moderate	Moderate	Slight	Slight	Paper birch---------	---	---	Jack pine, red pine, eastern white pine
							Red maple-----------	53	2	
							Bigtooth aspen------	---	---	
							Northern red oak----	---	---	
							Eastern hophornbeam-	55	6	
							Quaking aspen-------	---	---	
32B:										
Kellogg----------	3S	Slight	Moderate	Moderate	Slight	Moderate	Red maple-----------	67	3	Red pine, eastern white pine
							Paper birch---------	---	---	
							Eastern hophornbeam-	---	---	
							Balsam fir----------	---	---	
							Sugar maple---------	---	---	
							American beech------	---	---	
							Bigtooth aspen------	74	6	
							White ash-----------	---	---	
							American basswood---	56	3	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
35:										
Kinross	2W	Slight	Severe	Severe	Severe	Severe	Tamarack	---	---	---
							Red maple	---	---	
							Black spruce	---	---	
							Northern white-cedar	---	---	
							Eastern white pine	---	---	
							Quaking aspen	45	2	
47D:										
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							White oak	---	---	
48B:										
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Jack pine, red pine, eastern white pine
							Jack pine	53	5	
							Red maple	57	2	
							Red pine	53	6	
							Northern red oak	---	---	
							Eastern white pine	45	5	
							Quaking aspen	60	4	
							White oak	---	---	
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							White oak	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
48D:										
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Jack pine, red pine, eastern white pine
							Jack pine	53	5	
							Red maple	57	2	
							Red pine	53	6	
							Northern red oak	---	---	
							Eastern white pine	45	5	
							Quaking aspen	60	4	
							White oak	---	---	
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							White oak	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							Red maple	---	---	
48E:										
Rubicon	4R	Moderate	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Jack pine, red pine, eastern white pine
							Jack pine	53	5	
							Red maple	57	2	
							Red pine	53	6	
							Northern red oak	---	---	
							Eastern white pine	45	5	
							Quaking aspen	60	4	
							White oak	---	---	
Graycalm	6R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine	56	6	Red pine, eastern white pine
							Red pine	61	7	
							Eastern white pine	---	---	
							Paper birch	---	---	
							Bigtooth aspen	70	6	
							Red maple	---	---	
							Quaking aspen	60	4	
							Northern red oak	62	4	
							White oak	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
49B:										
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Slight	Sugar maple---------	64	3	Red pine, eastern white pine
							Eastern hemlock-----	---	---	
							American beech------	---	---	
							Red pine------------	---	---	
							Red maple-----------	63	3	
							Eastern white pine--	---	---	
							Black cherry--------	---	---	
							Bigtooth aspen------	80	7	
							Quaking aspen-------	---	---	
							Northern red oak----	---	---	
							Ironwood------------	---	---	
							American basswood---	---	---	
49B3:										
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Slight	Sugar maple---------	64	3	Red pine, eastern white pine
							Red maple-----------	63	3	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
							Bigtooth aspen------	80	7	
49C, 49D:										
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Slight	Sugar maple---------	64	3	Red pine, eastern white pine
							Eastern hemlock-----	---	---	
							American beech------	---	---	
							Red pine------------	---	---	
							Red maple-----------	63	3	
							Eastern white pine--	---	---	
							Black cherry--------	---	---	
							Bigtooth aspen------	80	7	
							Quaking aspen-------	---	---	
							Northern red oak----	---	---	
							Ironwood------------	---	---	
							American basswood---	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
49E:										
Kalkaska-------	3R	Moderate	Moderate	Moderate	Slight	Slight	Sugar maple---------	64	3	Red pine, eastern white pine
							Eastern hemlock-----	---	---	
							American beech------	---	---	
							Red pine-----------	---	---	
							Red maple-----------	63	3	
							Eastern white pine--	---	---	
							Black cherry--------	---	---	
							Bigtooth aspen------	80	7	
							Quaking aspen-------	---	---	
							Northern red oak----	---	---	
							Ironwood------------	---	---	
							American basswood---	---	---	
50B:										
Au Gres---------	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	65	3	Norway spruce, white spruce, red pine, eastern white pine
							Yellow birch--------	---	---	
							Paper birch---------	---	---	
							Balsam fir----------	---	---	
							Eastern white pine--	---	---	
							Eastern hemlock-----	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	70	6	
							Northern white-cedar	---	---	
Kinross---------	2W	Slight	Severe	Severe	Severe	Severe	Tamarack------------	---	---	---
							Red maple-----------	---	---	
							Black spruce--------	---	---	
							Quaking aspen-------	45	2	
							Eastern white pine--	---	---	
Croswell--------	5S	Slight	Moderate	Moderate	Moderate	Moderate	Paper birch---------	54	4	White spruce, red pine, eastern white pine
							Jack pine-----------	53	5	
							Red pine-----------	55	6	
							Red maple-----------	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Bigtooth aspen------	69	6	
							Quaking aspen-------	68	5	
							Black cherry--------	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
51:										
Tawas-----------	5W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	40	5	---
							Eastern hemlock-----	---	---	
							Red maple-----------	---	---	
							Northern white-cedar	---	---	
							Black ash-----------	---	---	
Leafriver-------	2W	Slight	Severe	Severe	Severe	Severe	Black spruce--------	---	---	Black ash,
							Paper birch---------	---	---	tamarack,
							Red maple-----------	---	---	black spruce
							Black ash-----------	55	2	
							Northern white-cedar	---	---	
53B, 53C:										
Negwegon--------	3L	Slight	Moderate	Slight	Moderate	Severe	Sugar maple---------	62	3	White spruce,
							Black cherry--------	---	---	eastern white
							American beech------	---	---	pine
							Eastern hemlock-----	---	---	
							White ash-----------	---	---	
							Bigtooth aspen------	---	---	
54A:										
Algonquin-------	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	---	---	White spruce,
							Paper birch---------	---	---	eastern white
							Balsam fir----------	45	6	pine, northern
							Black ash-----------	---	---	white-cedar
							Northern white-cedar	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	---	---	
58A:										
Wakeley---------	3W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	Northern white-
							Black spruce--------	---	---	cedar
							Northern white-cedar	---	---	
							Quaking aspen-------	50	3	
Allendale-------	4W	Slight	Severe	Slight	Moderate	Moderate	Red maple-----------	---	---	White spruce,
							Paper birch---------	---	---	eastern white
							Balsam fir----------	---	---	pine
							White ash-----------	---	---	
							Quaking aspen-------	60	4	
							White spruce--------	---	---	
							Eastern white pine--	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
75B, 75D:										
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Jack pine, red pine, eastern white pine
							Jack pine	53	5	
							Red maple	57	2	
							Red pine	53	6	
							Northern red oak	---	---	
							Eastern white pine	45	5	
							Quaking aspen	60	4	
							White oak	---	---	
75E:										
Rubicon	4R	Moderate	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Jack pine, red pine, eastern white pine
							Jack pine	53	5	
							Red maple	57	2	
							Red pine	53	6	
							Northern red oak	---	---	
							Eastern white pine	45	5	
							Quaking aspen	60	4	
							White oak	---	---	
78. Pits, borrow										
81B, 81D:										
Grayling	4S	Slight	Moderate	Moderate	Slight	Slight	Red pine	---	---	Jack pine, red pine
							Jack pine	48	4	
							Bigtooth aspen	---	---	
							Red maple	---	---	
							White oak	---	---	
							Northern pin oak	43	2	
81E, 81F:										
Grayling	4R	Moderate	Moderate	Moderate	Slight	Slight	Red pine	---	---	Jack pine, red pine
							Jack pine	48	4	
							Bigtooth aspen	---	---	
							Red maple	---	---	
							White oak	---	---	
							Northern pin oak	43	2	
83B, 83F. Udipsamments										

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
86. Histosols and Aquents										
87: Ausable	2W	Slight	Severe	Severe	Severe	Severe	Quaking aspen	---	---	---
							Red maple	---	---	
							Northern white-cedar	15	2	
							Balsam fir	---	---	
99: Roscommon	6W	Slight	Severe	Severe	Severe	Severe	Red maple	---	---	Tamarack, black spruce, northernwhite-cedar
							Balsam fir	---	---	
							Black spruce	---	---	
							Northern white-cedar	---	---	
							Bigtooth aspen	74	6	
131E: Rubicon	6R	Moderate	Moderate	Moderate	Slight	Slight	Red pine	---	---	Jack pine, red pine, eastern white pine
							Bigtooth aspen	75	4	
							Red maple	---	---	
Menominee	6R	Moderate	Moderate	Moderate	Slight	Moderate	Yellow birch	---	---	White spruce, red pine, eastern white pine
							Paper birch	---	---	
							White ash	77	5	
							Red pine	62	8	
							Sugar maple	---	---	
							Bigtooth aspen	76	6	
							White oak	---	---	
							Quaking aspen	74	6	
							Black cherry	---	---	
							Northern red oak	63	4	
							American basswood	---	---	
147B, 147C, 147D, 147E: Lindquist	6S	Slight	Moderate	Moderate	Slight	Slight	Paper birch	---	---	Jack pine, red pine, eastern white pine
							Jack pine	53	5	
							Red maple	57	2	
							Red pine	54	6	
							Northern red oak	---	---	
							Eastern white pine	45	5	
							Bigtooth aspen	66	5	
							Quaking aspen	60	4	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber (cu m/ha)	Suggested trees to plant
159A:										
Finch-----------	4W	Slight	Severe	Moderate	Severe	Severe	Paper birch---------	54	4	White spruce, red pine, eastern white pine
							Northern white-cedar	52	5	
							Red maple-----------	56	2	
							Black spruce--------	38	3	
							Balsam fir----------	56	3	
							Eastern white pine--	53	7	
							Bigtooth aspen------	56	4	
174A:										
Au Gres---------	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	65	3	Norway spruce, white spruce, red pine, eastern white pine
							Yellow birch--------	---	---	
							Paper birch---------	---	---	
							Balsam fir----------	---	---	
							Eastern white pine--	---	---	
							Eastern hemlock-----	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	70	6	
							Northern white-cedar	---	---	
Roscommon-------	6W	Slight	Severe	Severe	Severe	Severe	Red maple-----------	---	---	Tamarack, black spruce, northern white-cedar
							Balsam fir----------	---	---	
							Jack pine-----------	---	---	
							Northern white-cedar	---	---	
							Black spruce--------	---	---	
							Bigtooth aspen------	74	6	
197A:										
Gladwin---------	5W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	---	---	White spruce, eastern white pine
							Paper birch---------	69	6	
							Balsam fir----------	---	---	
							White spruce--------	---	---	
							White oak-----------	55	3	
							Eastern white pine--	55	7	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	68	4	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
338B, 338C, 338D:										
Islandlake------	3S	Slight	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce,
							American beech------	---	---	red pine,
							Eastern white pine--	---	---	eastern white
							Sugar maple---------	64	3	pine
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
338E:										
Islandlake------	3R	Moderate	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce,
							American beech------	---	---	red pine,
							Eastern white pine--	---	---	eastern white
							Sugar maple---------	64	3	pine
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
360:										
Wakeley---------	3W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	Northern white-
							Black spruce--------	---	---	cedar
							Northern white-cedar	---	---	
							Quaking aspen-------	50	3	
366B, 366C, 366D:										
Islandlake------	3S	Slight	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce,
							American beech------	---	---	red pine,
							Eastern white pine--	---	---	eastern white
							Sugar maple---------	64	3	pine
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
366B, 366C, 366D:										
Blue Lake	3A	Slight	Slight	Slight	Slight	Moderate	Yellow birch	---	---	Jack pine, red pine, eastern white pine
							American beech	---	---	
							Sugar maple	64	3	
							Eastern white pine	---	---	
							Eastern hemlock	---	---	
							Bigtooth aspen	---	---	
							Quaking aspen	---	---	
							American basswood	---	---	
366E:										
Islandlake	3R	Moderate	Moderate	Moderate	Slight	Slight	Yellow birch	---	---	White spruce, red pine, eastern white pine
							American beech	---	---	
							Eastern white pine	---	---	
							Sugar maple	64	3	
							Bigtooth aspen	---	---	
							Eastern hemlock	---	---	
							Black cherry	---	---	
							Northern red oak	---	---	
							American basswood	---	---	
Blue Lake	3A	Slight	Slight	Slight	Slight	Moderate	Yellow birch	---	---	Jack pine, red pine, eastern white pine
							American beech	---	---	
							Sugar maple	64	3	
							Eastern white pine	---	---	
							Eastern hemlock	---	---	
							Bigtooth aspen	---	---	
							Quaking aspen	---	---	
							American basswood	---	---	
371:										
Springport	6W	Slight	Severe	Severe	Severe	Severe	Paper birch	---	---	White spruce, eastern white pine, northern white-cedar
							Black ash	---	---	
							Balsam fir	45	6	
							Balsam poplar	---	---	
							Red maple	---	---	
							Bigtooth aspen	---	---	
							Northern white-cedar	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordi- nation symbol	Management concerns: Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
380. Access denied										
402B: Islandlake------	3A	Slight	Slight	Slight	Slight	Moderate	Yellow birch--------	---	---	White spruce, blue spruce, red pine, eastern white pine, Scotch pine
							American beech------	---	---	
							Eastern white pine--	---	---	
							Sugar maple---------	64	3	
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
402C: Islandlake------	3S	Slight	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce, blue spruce, red pine, eastern white pine, Scotch pine
							American beech------	---	---	
							Eastern white pine--	---	---	
							Sugar maple---------	64	3	
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
406A: Winterfield-----	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	65	3	White spruce, eastern white pine, northern white-cedar
							Paper birch---------	---	---	
							Quaking aspen-------	70	6	
							Eastern white pine--	---	---	
412A: Ingalls---------	4W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	---	---	White spruce, eastern white pine, northern white-cedar
							Paper birch---------	---	---	
							Black ash-----------	---	---	
							Balsam fir----------	---	---	
							Jack pine-----------	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	60	4	
							Eastern white pine--	---	---	
							Northern white-cedar	---	---	
							Eastern hemlock-----	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
412A:										
Burleigh--------	2W	Slight	Severe	Severe	Severe	Severe	Black ash-----------	---	---	---
							Red maple-----------	---	---	
							Quaking aspen-------	40	2	
							Northern white-cedar	---	---	
							Swamp white oak-----	---	---	
454B, 454C, 454D:										
Springlake------	3S	Slight	Moderate	Moderate	Slight	Slight	Paper birch---------	---	---	Jack pine, red pine, eastern white pine
							American basswood---	62	8	
							Sugar maple---------	60	3	
							Quaking aspen-------	---	---	
							Ironwood------------	---	---	
							American beech------	---	---	
							Black cherry--------	---	---	
454E:										
Springlake------	3S	Moderate	Moderate	Moderate	Slight	Slight	American beech------	---	---	---
							Black cherry--------	---	---	
							Ironwood------------	---	---	
							Sugar maple---------	60	3	
							Quaking aspen-------	---	---	
							Paper birch---------	---	---	
							American basswood---	62	8	
457B, 457C, 457D:										
Islandlake------	3S	Slight	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce, red pine, eastern white pine
							American beech------	---	---	
							Eastern white pine--	---	---	
							Sugar maple---------	64	3	
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
Southwells------	3A	Slight	Slight	Moderate	Slight	Moderate	Yellow birch--------	---	---	Blue spruce, red pine, eastern white pine, Scotch pine
							American beech------	---	---	
							Sugar maple---------	60	3	
							Bigtooth aspen------	---	---	
							Eastern hophornbeam-	---	---	
							Black cherry--------	---	---	
							American basswood---	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber	Suggested trees to plant
									cu m/ha	
457E:										
Islandlake------	3R	Moderate	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce,
							American beech------	---	---	red pine,
							Eastern white pine--	---	---	eastern white
							Sugar maple---------	64	3	pine
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
Southwells------	3R	Moderate	Moderate	Moderate	Slight	Moderate	Yellow birch--------	---	---	Blue spruce,
							American beech------	---	---	red pine,
							Sugar maple---------	60	3	eastern white
							Bigtooth aspen------	---	---	pine, Scotch
							Eastern hophornbeam-	---	---	pine
							Black cherry--------	---	---	
							American basswood---	---	---	
458D:										
Islandlake------	3S	Slight	Moderate	Moderate	Slight	Slight	Yellow birch--------	---	---	White spruce,
							American beech------	---	---	red pine,
							Eastern white pine--	---	---	eastern white
							Sugar maple---------	64	3	pine
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
							American basswood---	---	---	
Menominee-------	6S	Slight	Moderate	Moderate	Slight	Moderate	Paper birch---------	---	---	White spruce
							White ash-----------	77	5	
							Red pine------------	62	8	
							Sugar maple---------	---	---	
							Bigtooth aspen------	76	6	
							American basswood---	---	---	
							Quaking aspen-------	74	6	
							Black cherry--------	---	---	
							White oak-----------	77	5	
							Northern red oak----	63	4	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
459B, 459D:										
Rubicon---------	5S	Slight	Moderate	Moderate	Slight	Slight	Sugar maple---------	---	---	Red pine, eastern white pine
							Red maple----------	57	2	
							American beech------	---	---	
							Northern red oak----	---	---	
							Red pine-----------	53	6	
							Eastern white pine--	45	5	
459E:										
Rubicon---------	5R	Moderate	Moderate	Moderate	Slight	Slight	Sugar maple---------	---	---	Red pine, eastern white pine
							American beech------	---	---	
							Red maple----------	57	2	
							Red pine-----------	53	6	
							Northern red oak----	---	---	
							Eastern white pine--	45	5	
							Bigtooth aspen------	66	4	
460B, 460C:										
Rubicon---------	5S	Slight	Moderate	Moderate	Slight	Slight	Sugar maple---------	---	---	Red pine, eastern white pine
							Red maple----------	57	2	
							American beech------	---	---	
							Northern red oak----	---	---	
							Red pine-----------	53	6	
							Eastern white pine--	45	5	
Mancelona-------	3S	Slight	Moderate	Moderate	Slight	Moderate	Sugar maple---------	58	3	Jack pine, red pine, eastern white pine
							Black cherry--------	---	---	
							Bigtooth aspen------	---	---	
							Eastern hophornbeam-	---	---	
460D:										
Rubicon---------	5S	Slight	Moderate	Moderate	Slight	Slight	Sugar maple---------	---	---	Red pine, eastern white pine
							Red maple----------	57	2	
							American beech------	---	---	
							Northern red oak----	---	---	
							Red pine-----------	53	6	
							Eastern white pine--	45	5	
Mancelona-------	3S	Slight	Moderate	Moderate	Slight	Moderate	Eastern hophornbeam-	---	---	Jack pine, red pine, eastern white pine
							Sugar maple---------	58	3	
							Jack pine-----------	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
460E:										
Rubicon	5R	Moderate	Moderate	Moderate	Slight	Slight	Sugar maple	---	---	Red pine, eastern white pine
							Red maple	57	2	
							American beech	---	---	
							Northern red oak	---	---	
							Red pine	53	6	
							Eastern white pine	45	5	
Mancelona	3R	Moderate	Moderate	Moderate	Slight	Moderate	Black cherry	---	---	Jack pine, red pine, eastern white pine
							Sugar maple	58	3	
							Jack pine	---	---	
							Bigtooth aspen	---	---	
							Eastern hophornbeam	---	---	
460F:										
Rubicon	5R	Severe	Severe	Moderate	Slight	Slight	Sugar maple	---	---	Red pine, eastern white pine
							Red maple	57	2	
							American beech	---	---	
							Northern red oak	---	---	
							Red pine	53	6	
							Eastern white pine	45	5	
Mancelona	3R	Severe	Severe	Moderate	Slight	Moderate	Sugar maple	58	3	Jack pine, red pine, eastern white pine
							Black cherry	---	---	
							Bigtooth aspen	---	---	
							Eastern hophornbeam	---	---	
461A:										
Allendale	4W	Slight	Severe	Slight	Moderate	Moderate	Red maple	---	---	White spruce, eastern white pine
							Paper birch	---	---	
							Balsam fir	---	---	
							Sugar maple	---	---	
							Yellow birch	---	---	
							White spruce	---	---	
							Eastern white pine	---	---	
							Quaking aspen	60	4	
Springport	6W	Slight	Severe	Severe	Severe	Severe	Paper birch	---	---	White spruce, eastern white pine, northern white-cedar
							Black ash	---	---	
							Balsam fir	45	6	
							Quaking aspen	---	---	
							Red maple	---	---	
							Northern white-cedar	---	---	
							Bigtooth aspen	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
462A:										
Allendale-------	4W	Slight	Severe	Slight	Moderate	Moderate	Red maple-----------	---	---	White spruce, eastern white pine
							Paper birch---------	---	---	
							Balsam fir----------	---	---	
							Sugar maple---------	---	---	
							Yellow birch--------	---	---	
							White spruce--------	---	---	
							Eastern white pine--	---	---	
							Quaking aspen-------	60	4	
Algonquin-------	6W	Slight	Severe	Moderate	Severe	Severe	Red maple-----------	---	---	White spruce, eastern white pine, northern white-cedar
							Paper birch---------	---	---	
							Balsam fir----------	45	6	
							Black ash-----------	---	---	
							Northern white-cedar	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	---	---	
466B:										
Halfaday--------	3S	Slight	Moderate	Moderate	Moderate	Moderate	American beech------	---	---	Red pine, eastern white pine
							Black cherry--------	---	---	
							Red maple-----------	---	---	
							Sugar maple---------	62	3	
467B, 467C:										
Morganlake------	6S	Slight	Slight	Slight	Slight	Moderate	Yellow birch--------	---	---	White spruce, red pine, eastern white pine
							Sugar maple---------	---	---	
							Bigtooth aspen------	76	6	
							American basswood---	---	---	
							Quaking aspen-------	74	6	
							Black cherry--------	---	---	
Woodman---------	3C	Slight	Moderate	Slight	Moderate	Severe	Sugar maple---------	62	3	White spruce, eastern white pine
							American beech------	---	---	
							Bigtooth aspen------	---	---	
							White ash-----------	---	---	
Blue Lake-------	3A	Slight	Slight	Slight	Slight	Moderate	Yellow birch--------	---	---	Jack pine, red pine, eastern white pine
							American beech------	---	---	
							Sugar maple---------	64	3	
							Eastern white pine--	---	---	
							Eastern hemlock-----	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	---	---	
							American basswood---	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
468F:										
Southwells------	3R	Moderate	Moderate	Moderate	Slight	Moderate	Sugar maple---------	60	3	Blue spruce, red pine, eastern white pine, Scotch pine
							Yellow birch--------	---	---	
							Eastern hophornbeam-	---	---	
							American beech------	---	---	
							American basswood---	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	
Mancelona-------	3R	Moderate	Moderate	Moderate	Slight	Moderate	Sugar maple---------	58	3	Jack pine, red pine, eastern white pine
							Black cherry--------	---	---	
							Bigtooth aspen------	---	---	
							Eastern hophornbeam-	---	---	
Dighton---------	3C	Slight	Moderate	Slight	Moderate	Severe	Eastern hophornbeam-	---	---	White spruce, eastern white pine
							Balsam fir----------	---	---	
							Sugar maple---------	62	3	
							American basswood---	---	---	
							American beech------	---	---	
							Eastern hemlock-----	---	---	
							White ash-----------	---	---	
							Bigtooth aspen------	---	---	
							Northern red oak----	---	---	
469B:										
Hodenpyl--------	3A	Slight	Moderate	Slight	Slight	Moderate	Sugar maple---------	60	3	Norway spruce, red pine, eastern white pine
							Eastern hophornbeam-	---	---	
							American beech------	---	---	
							Eastern hemlock-----	---	---	
							Black cherry--------	---	---	
							Northern red oak----	---	---	
Montcalm--------	3A	Slight	Slight	Slight	Slight	Moderate	American basswood---	---	---	White spruce, red pine, eastern white pine
							Balsam fir----------	---	---	
							Red maple-----------	---	---	
							Sugar maple---------	61	3	
							Eastern hophornbeam-	---	---	
							Yellow birch--------	---	---	
							Northern red oak----	66	4	
							Paper birch---------	---	---	
							Red pine------------	---	---	
							Eastern white pine--	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	---	---	

Table 7.—Woodland Management and Productivity—Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber	Suggested trees to plant
									cu m/ha	
471B:										
Mancelona-------	3S	Slight	Moderate	Moderate	Slight	Moderate	Sugar maple---------	58	3	Jack pine, red pine, eastern white pine
							Eastern hophornbeam-	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	
Blue Lake-------	3A	Slight	Slight	Slight	Slight	Moderate	Yellow birch--------	---	---	Jack pine, red pine, eastern white pine
							American beech------	---	---	
							Sugar maple---------	64	3	
							Eastern white pine--	---	---	
							Eastern hemlock-----	---	---	
							Bigtooth aspen------	---	---	
							Quaking aspen-------	---	---	
							American basswood---	---	---	
472B:										
Morganlake------	6S	Slight	Slight	Slight	Slight	Moderate	Yellow birch--------	---	---	White spruce, red pine, eastern white pine
							Sugar maple---------	---	---	
							Bigtooth aspen------	76	6	
							American basswood---	---	---	
							Quaking aspen-------	74	6	
							Black cherry--------	---	---	
488A:										
Allendale-------	4W	Slight	Severe	Slight	Moderate	Moderate	Red maple-----------	---	---	White spruce, eastern white pine
							Balsam fir----------	---	---	
							White ash-----------	---	---	
							Quaking aspen-------	60	4	
							White spruce--------	---	---	
							Eastern white pine--	---	---	
494:										
Gauld-----------	2W	Slight	Severe	Severe	Severe	Severe	Paper birch---------	---	---	---
							Red maple-----------	---	---	
							Red pine------------	---	---	
							Quaking aspen-------	61	5	
							Northern white-cedar	---	---	
W. Water										

Table 8.—Equipment Limitations on Woodland

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe". Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log Landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log Landings	Ratings for preferred operating season(s): Haul roads
13*:							
Tawas	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
14*:							
Dawson	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Loxley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
15A*:							
Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
16B Graycalm	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
16E Graycalm	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
17A Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log Landings	Haul roads		Logging areas and skid roads	Log Landings	Haul roads
18A----------- Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
19------------ Leafriver	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight---------	Slight---------	Slight.
20B*:							
Graycalm-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Grayling-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
20D*:							
Graycalm-----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
Grayling-----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Moderate: slope.
20F*:							
Graycalm-----	Moderate:** slope.	Severe: slope.	Moderate:** slope.	Spring, fall, winter.	Moderate:** slope.	Severe: slope.	Moderate:** slope.
Grayling-----	Moderate:** slope.	Severe: slope.	Moderate:** slope.	Spring, fall, winter.	Moderate:** slope.	Severe: slope.	Moderate:** slope.
21B*:							
Graycalm-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Klacking-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log Landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log Landings	Ratings for preferred operating season(s): Haul roads
21D*:							
Graycalm	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Klacking	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
21F*:							
Graycalm	Moderate:** slope.	Severe: slope.	Moderate:** slope.	Spring, fall, winter.	Moderate:** slope.	Severe: slope.	Moderate:** slope.
Klacking	Moderate:** slope.	Severe: slope.	Moderate:** slope.	Spring, fall, winter.	Moderate:** slope.	Severe: slope.	Moderate:** slope.
22B*:							
Montcalm	Slight	Slight	Slight	Year-round	Slight	Slight	Slight.
23*:							
Ausable	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Bowstring	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
24A*:							
Kinross	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
26B: Cublake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log Landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log Landings	Ratings for preferred operating season(s): Haul roads
28B----------- East Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
32B----------- Kellogg	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
35------------ Kinross	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
47D----------- Graycalm	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
48B*:							
Rubicon------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Graycalm-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
48D*:							
Rubicon------	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
Graycalm-----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
48E*:							
Rubicon------	Moderate: too sandy, slope.	Severe: too sandy, slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Graycalm-----	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log Landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log Landings	Ratings for preferred operating season(s): Haul roads
49B, 49B3----- Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
49C, 49D------ Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
49E----------- Kalkaska	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
50B*:							
Au Gres------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
Kinross------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
Croswell-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
51*:							
Tawas--------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Leafriver----	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight---------	Slight---------	Slight.
53B----------- Negwegon	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight---------	Slight---------	Slight.
53C----------- Negwegon	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight---------	Moderate: slope.	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log Landings	Haul roads		Logging areas and skid roads	Log Landings	Haul roads
54A----------- Algonquin	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight---------	Slight---------	Slight.
58A*:							
Wakeley------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight---------	Slight---------	Slight.
Allendale----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
75B----------- Rubicon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall winter.	Slight---------	Slight---------	Slight.
75D----------- Rubicon	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall winter.	Slight---------	Moderate: slope.	Slight.
75E----------- Rubicon	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
78. Pits, borrow							
81B----------- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
81D----------- Grayling	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
81E----------- Grayling	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log Landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log Landings	Haul roads
81F**: Grayling	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
83B, 83F. Udipsamments							
86. Histosols and Aquents							
87: Ausable	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
99: Roscommon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
131E*:							
Rubicon	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Menominee	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
147B: Lindquist	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
147C, 147D: Lindquist	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
147E: Lindquist	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log Landings	Haul roads		Logging areas and skid roads	Log Landings	Haul roads
159A---------- Finch	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
174A*:							
Au Gres------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
Roscommon----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
197A---------- Gladwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
338B---------- Islandlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
338C, 338D---- Islandlake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
338E---------- Islandlake	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
360----------- Wakeley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight---------	Slight---------	Slight.
366B*:							
Islandlake---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Blue Lake----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log Landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log Landings	Haul roads
366C, 366D*:							
Islandlake---	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
Blue Lake----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
366E*:							
Islandlake---	Moderate: too sandy, slope.	Severe: slope, too sandy.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Blue Lake----	Moderate: too sandy, slope.	Severe: slope, too sandy.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
371----------- Springport	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight---------	Slight---------	Slight.
380. Access denied							
402B---------- Islandlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
402C---------- Islandlake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
406A---------- Winterfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred oeprating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log Landings	Haul roads		Logging areas and skid roads	Log Landings	Haul roads
412A*:							
Ingalls------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
Burleigh-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight---------	Slight---------	Slight.
454B---------- Springlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
454C, 454D---- Springlake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
454E---------- Springlake	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
457B*:							
Islandlake---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Southwells---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
457C, 457D*:							
Islandlake---	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
Southwells---	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log Landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log Landings	Ratings for preferred operating season(s): Haul roads
457E*:							
Islandlake---	Moderate: too sandy. slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Southwells---	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
458D*:							
Islandlake---	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
Menominee----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
459B---------- Rubicon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
459D---------- Rubicon	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
459E---------- Rubicon	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
460B*:							
Rubicon------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Mancelona----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log Landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log Landings	Ratings for preferred operating season(s): Haul roads
460C, 460D*:							
Rubicon	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Mancelona	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
460E*:							
Rubicon	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Mancelona	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
460F*:							
Rubicon	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Mancelona	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
461A*:							
Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Springport	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
462A*:							
Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Algonquin	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log Landings	Haul roads		Logging areas and skid roads	Log Landings	Haul roads
466B---------- Halfaday	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
467B*:							
Morganlake---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
Woodman------	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight---------	Slight---------	Slight.
Blue Lake----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight---------	Slight.
467C*:							
Morganlake---	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
Woodman------	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight---------	Moderate: slope.	Slight.
Blue Lake----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.	Slight.
468F*:							
Southwells---	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Mancelona----	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Dighton------	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

Table 8.—Equipment Limitations on Woodland—Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log Landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log Landings	Haul roads
469B*:							
Hodenpyl	Slight	Slight	Slight	Year-round	Slight	Slight	Slight.
Montcalm	Slight	Slight	Slight	Year-round	Slight	Slight	Slight.
471B*:							
Mancelona	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Blue Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
472B Morganlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
488A Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
494 Gauld	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
W. Water							

* See description of the map unit for composition and behavior characteristics of the map unit.
** Part of the soil may rate severe.

Table 9.—Soils and Associated Plant Communities

(Absence of a map unit or an entry indicates that information was not available)

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
13----------------	Northern white-cedar 5	Northern white-cedar 2	Speckled alder------ 3	Sensitive fern------ 2	Goldthread---------- 2
Tawas-Lupton	Red maple---------- 2	Balsam fir--------- 1	Willow spp.--------- 3	Lady fern---------- 2	Grass spp.---------- 2
	Paper birch--------- 2	Black ash---------- 1		Cinnamon fern------- 1	Miterwort spp.------- 2
	Balsam fir--------- 2	Yellow birch-------- 1		Ostrich fern-------- 1	Sphagnum moss spp.--- 2
	Eastern hemlock----- 2	Red maple---------- 1		Shield fern--------- 1	Sedge spp.---------- 2
	Black spruce-------- 1	Eastern hemlock----- 1			Bedstraw/cleavers---- 1
	Black ash---------- 1	Black spruce-------- 1			Bramble spp.--------- 1
	Yellow birch-------- 1	Paper birch--------- 1			Bugleweed----------- 1
	Tamarack----------- 1	Tamarack----------- 1			Buttercup spp.------- 1
					Goldenrod spp.------- 1
					Horsetail spp.------- 1
					Jack-in-the-pulpit--- 1
					Marsh marigold------- 1
					Nettle spp.---------- 1
					Sweet coltsfoot------ 1
					Violet spp.---------- 1
					Blueflag------------ 1
					Cattail spp.--------- 1
14----------------	Tamarack----------- 3	Tamarack----------- 2	Leatherleaf--------- 5	---	Sphagnum moss-------- 7
Dawson-Loxley	Jack pine---------- 2	Jack pine---------- 1	Willow spp.--------- 1		Pale laurel---------- 3
	Black spruce-------- 2	Black spruce-------- 1			Bog rosemary--------- 3
	Eastern white pine-- 1	Eastern white pine-- 1			Labrador tea--------- 2
					Sedge spp.---------- 1
15A:					
Croswell---------	Bigtooth aspen------ 5	Red maple---------- 3	Serviceberry-------- 1	Bracken fern-------- 4	Wintergreen--------- 4
	Red maple---------- 4	Eastern white pine-- 2	Witchhazel--------- 1	Running pine-------- 2	Canada blueberry----- 3
	Eastern white pine-- 3	Northern red oak---- 1		Ground cedar-------- 1	Grass spp.---------- 3
	Northern red oak---- 2	Black cherry-------- 1		Shining clubmoss---- 1	Low bush blueberry--- 2
	Quaking aspen------- 2	Balsam fir--------- 1			Sedge spp.---------- 2
	Jack pine---------- 2				Blue cladonia-------- 2
	Balsam fir--------- 2				Barren strawberry---- 2
	Black cherry-------- 1				Wild strawberry------ 2
	Red pine----------- 1				Bedstraw/cleavers---- 1
					Bramble spp.--------- 1
					Bunchberry---------- 1
					Starflower---------- 1
					Sweetfern----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
15A:					
Au Gres----------	Red maple---------- 3	Red maple---------- 3	Redosier dogwood---- 1	Bracken fern-------- 3	Low bush blueberry--- 4
	Balsam fir---------- 3	Balsam fir---------- 2	Speckled alder------ 1	Lady fern----------- 1	Bunchberry---------- 3
	Eastern white pine-- 3	Eastern white pine-- 1	Willow spp.--------- 1	Sensitive fern------ 1	Canada blueberry----- 3
	Bigtooth aspen------ 2	Paper birch--------- 1		Running pine-------- 2	Canada mayflower----- 2
	Quaking aspen------- 2	White spruce-------- 1		Ground cedar-------- 1	Wintergreen---------- 2
	Paper birch--------- 2			Shining clubmoss---- 1	Goldthread---------- 2
	Eastern hemlock----- 2			Staghorn clubmoss--- 1	Grass spp.---------- 2
	Yellow birch-------- 1			Stiff clubmoss------ 1	Sedge spp.---------- 2
	Sugar maple--------- 1			Ground pine--------- 1	Starflower---------- 2
	Northern white-cedar 1				Partridgeberry------- 1
	White spruce-------- 1				Bedstraw/cleavers---- 1
16B, 16E----------	Bigtooth aspen------ 5	Red maple---------- 3	Serviceberry-------- 2	Bracken fern-------- 3	Canada blueberry----- 4
Graycalm	Northern red oak---- 4	Northern red oak---- 2	Witchhazel---------- 1	Shining clubmoss---- 2	Low bush blueberry--- 4
	Red maple---------- 3	White oak---------- 2		Ground cedar-------- 1	Sweetfern----------- 4
	White oak---------- 2	Bigtooth aspen------ 1		Running pine-------- 1	Grass spp.---------- 3
	Jack pine---------- 2			Staghorn clubmoss--- 1	Wintergreen---------- 2
	Paper birch--------- 1			Stiff clubmoss------ 1	Bearberry----------- 2
	Black cherry-------- 1			Ground pine--------- 1	Blue cladonia-------- 2
	Eastern white pine-- 1				Bramble spp.--------- 2
	Red pine----------- 1				Sedge spp.---------- 2
					Trailing arbutus----- 2
					Canada mayflower----- 1
					Starflower---------- 1
17A--------------	Bigtooth aspen------ 5	Red maple---------- 3	Serviceberry-------- 1	Bracken fern-------- 4	Wintergreen---------- 4
Croswell	Red maple---------- 4	Eastern white pine-- 2	Witchhazel---------- 1	Running pine-------- 2	Canada blueberry----- 3
	Eastern white pine-- 3	Northern red oak---- 1		Ground cedar-------- 1	Grass spp.---------- 3
	Northern red oak---- 2	Black cherry-------- 1		Shining clubmoss---- 1	Low bush blueberry--- 2
	Quaking aspen------- 2	Balsam fir---------- 1			Sedge spp.---------- 2
	Jack pine---------- 2				Blue cladonia-------- 2
	Balsam fir---------- 2				Barren strawberry---- 2
	Black cherry-------- 1				Wild strawberry------ 1
	Red pine----------- 1				Bedstraw/cleavers---- 1
					Bramble spp.--------- 1
					Bunchberry---------- 1
					Starflower---------- 1
					Sweetfern----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
18A----------------	Red maple----------- 3	Red maple----------- 3	Redosier dogwood---- 1	Bracken fern-------- 3	Low bush blueberry--- 4
Au Gres	Balsam fir---------- 3	Balsam fir---------- 2	Speckled alder------ 1	Lady fern----------- 1	Bunchberry----------- 3
	Eastern white pine-- 3	Eastern white pine-- 1	Willow spp.--------- 1	Sensitive fern------ 1	Canada blueberry----- 3
	Bigtooth aspen------ 2	Paper birch--------- 1		Running pine-------- 2	Canada mayflower----- 2
	Quaking aspen------- 2	White spruce-------- 1		Ground cedar-------- 1	Wintergreen---------- 2
	Paper birch--------- 2			Shining clubmoss---- 1	Goldthread----------- 2
	Eastern hemlock----- 2			Staghorn clubmoss--- 1	Grass spp.----------- 2
	Yellow birch-------- 1			Stiff clubmoss------ 1	Sedge spp.----------- 2
	Sugar maple--------- 1			Ground pine--------- 1	Starflower----------- 2
	Northern white-cedar 1				Partridgeberry------- 1
	White spruce-------- 1				Bedstraw/cleavers---- 1
19----------------	Northern white-cedar 4	Northern white-cedar 2	Speckled alder------ 2	Lady fern----------- 1	Sedge spp.----------- 3
Leafriver	Red maple----------- 3	Red maple----------- 2		Shield fern--------- 1	Sphagnum moss-------- 3
	Black ash----------- 2	Black ash----------- 1		Sensitive fern------ 1	Bedstraw/cleavers---- 2
	Paper birch--------- 2	Paper birch--------- 1			Dewberry spp.-------- 2
	Yellow birch-------- 2	Yellow birch-------- 1			Goldthread----------- 2
	Balsam fir---------- 2	Balsam fir---------- 1			Grass spp.----------- 2
	Eastern white pine-- 2	Eastern white pine-- 1			Marsh marigold------- 2
	Black spruce-------- 2	Black spruce-------- 1			Miterwort spp.------- 2
	Eastern hemlock----- 1				Canada mayflower----- 2
					Starflower----------- 2
					Yellow beadlily------ 1
					Bunchberry----------- 1
					Horsetail spp.------- 1
					Indian pipe---------- 1
					Jack-in-the-pulpit--- 1
					Blue flag------------ 1
					Jewelweed------------ 1
					Joe-pye-weed spp.---- 1
					Large leaf aster----- 1
					Meadow-rue spp.------ 1
					Mint spp.------------ 1
					Stinging nettles----- 1
					Orchid spp.---------- 1
					Sweet coltsfoot------ 1
					Twinflower----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
20B---------------	Jack pine----------- 6	Red maple----------- 2	Serviceberry-------- 1	Bracken fern-------- 3	Low bush blueberry--- 5
Graycalm-Grayling	Bigtooth aspen------ 5	Northern red oak---- 2	Witchhazel---------- 1	Shining clubmoss---- 2	Canada blueberry----- 4
	Northern red oak---- 4	White oak----------- 2		Ground cedar-------- 1	Sweetfern------------ 4
	Red maple----------- 3	Bigtooth aspen------ 1		Running pine-------- 1	Grass spp.----------- 3
	White oak----------- 2			Staghorn clubmoss--- 1	Bearberry------------ 3
	Paper birch--------- 1			Stiff clubmoss------ 1	Blue cladonia-------- 3
	Black cherry-------- 1			Ground pine--------- 1	Reindeer lichen------ 3
	Eastern white pine-- 1				Bramble spp.--------- 2
	Red pine-------------1				Sedge spp.----------- 2
					Trailing arbutus----- 2
					Wintergreen---------- 2
					Starflower----------- 1
					Canada mayflower----- 1
20D, 20F----------	Bigtooth aspen------ 5	Red maple----------- 2	Serviceberry-------- 1	Bracken fern-------- 3	Low bush blueberry--- 5
Graycalm-Grayling	Northern red oak---- 4	Northern red oak---- 2	Witchhazel---------- 1	Shining clubmoss---- 2	Canada blueberry----- 4
	Red maple----------- 3	White oak----------- 2		Ground cedar-------- 1	Sweetfern------------ 4
	Jack pine----------- 2	Bigtooth aspen------ 1		Running pine-------- 1	Grass spp.----------- 3
	White oak----------- 2			Staghorn clubmoss--- 1	Bearberry------------ 3
	Quaking aspen------- 2			Stiff clubmoss------ 1	Blue cladonia-------- 3
	Chokecherry--------- 2			Ground pine--------- 1	Reindeer lichen------ 3
	Eastern white pine-- 1				Bramble spp.--------- 2
	Red pine------------ 1				Sedge spp.----------- 2
	Paper birch--------- 1				Trailing arbutus----- 2
	Black cherry-------- 1				Wintergreen---------- 2
					Starflower----------- 1
					Canada mayflower----- 1
21B, 21D, 21F-----	Red maple----------- 4	---	Beaked hazelnut----- 2	Bracken fern-------- 4	Canada blueberry----- 3
Graycalm-Klacking	Northern red oak---- 4		Mapleleaf viburnum-- 2	Ground cedar-------- 1	Low bush blueberry--- 3
	Bigtooth aspen------ 3		Serviceberry-------- 2	Tree clubmoss------- 1	Grass spp.----------- 3
	Quaking aspen------- 2		Witchhazel---------- 2		Canada mayflower----- 2
	Black cherry-------- 2				Bramble spp.--------- 2
	Eastern hemlock----- 2				Wintergreen---------- 2
	White oak----------- 1				Sweetfern------------ 2
	Eastern white pine-- 1				Goldenrod spp.------- 1
	Red pine------------ 1				Large leaf aster----- 1
	Jack pine----------- 1				
	Northern pin oak---- 1				

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
22B---------------Montcalm	Sugar maple--------- 4	Sugar maple--------- 3	Witchhazel---------- 1	Bracken fern-------- 3	Grass spp.----------- 2
	Quaking aspen------- 2	Hophornbeam--------- 2		Shield fern--------- 1	Trillium spp.-------- 2
	American basswood--- 2	Northern red oak---- 1			Sweet cicely--------- 2
	Hophornbeam--------- 2				Canada white violet-- 1
	Northern red oak---- 2				Herb Robert---------- 1
	Yellow birch-------- 1				Bedstraw/cleavers---- 1
23----------------Ausable-Bowstring	Northern white-cedar 4	Northern white-cedar 1	Speckled alder------ 4	Lady fern----------- 1	Sedge spp.----------- 5
	Quaking aspen------- 3	Black ash----------- 1	Willow spp.--------- 2	Bracken fern-------- 1	Bunchberry----------- 2
	Red maple----------- 2	Red maple----------- 1	Leatherleaf--------- 2	Sensitive fern------ 1	Bedstraw/cleavers---- 2
	Balsam fir---------- 2	Balsam fir---------- 1	Redosier dogwood---- 1	Cinnamon fern------- 1	Cinquefoil spp.------ 2
	Eastern hemlock----- 2	Eastern hemlock----- 1			Goldenrod spp.------- 2
	Black ash----------- 2	Green ash----------- 1			Blue flag------------ 2
	Balsam poplar------- 1	Paper birch--------- 1			Miterwort spp.------- 2
	Paper birch--------- 1	Yellow birch-------- 1			Violet spp.---------- 2
	Yellow birch-------- 1				Meadow-rue spp.------ 2
	Eastern white pine-- 1				Dewberry spp.-------- 1
	Green ash----------- 1				Grass spp.----------- 1
					Jewelweed------------ 1
24A:					
Kinross----------	Red maple----------- 4	Red maple----------- 2	Speckled alder------ 1	---	Sphagnum moss-------- 3
	Tamarack------------ 2	Black spruce-------- 1			Goldthread----------- 2
	Eastern white pine-- 1	Tamarack------------ 1			Miterwort spp.------- 2
	Black spruce-------- 1				Twinflower----------- 2
Au Gres----------	Red maple----------- 3	Red maple----------- 3	Redosier dogwood---- 1	Bracken fern-------- 3	Low bush blueberry--- 4
	Balsam fir---------- 3	Balsam fir---------- 2	Speckled alder------ 1	Lady fern----------- 1	Bunchberry----------- 3
	Eastern white pine-- 3	Eastern white pine-- 1	Willow spp.--------- 1	Sensitive fern------ 1	Canada blueberry----- 3
	Bigtooth aspen------ 2	Paper birch--------- 1		Running pine-------- 2	Canada mayflower----- 2
	Quaking aspen------- 2	White spruce-------- 1		Ground cedar-------- 1	Wintergreen---------- 2
	Paper birch--------- 2			Shining clubmoss---- 1	Goldthread----------- 2
	Eastern hemlock----- 2			Staghorn clubmoss--- 1	Grass spp.----------- 2
	Yellow birch-------- 1			Stiff clubmoss------ 1	Sedge spp.----------- 2
	Sugar maple--------- 1			Ground pine--------- 1	Starflower----------- 2
	Northern white-cedar 1				Partridgeberry------- 1
	White spruce-------- 1				Bedstraw/cleavers---- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
28B--------------- East Lake	Red maple----------- 5 Northern red oak---- 4 Bigtooth aspen------ 3 Hophornbeam--------- 3 Black cherry-------- 2 Paper birch--------- 1 Eastern white pine-- 1 White spruce-------- 1	Red maple----------- 4 Northern red oak---- 3 Bigtooth aspen------ 2 Black cherry-------- 1 Paper birch--------- 1 Eastern white pine-- 1 White spruce-------- 1	Serviceberry-------- 3 Witchhazel---------- 1	Bracken fern-------- 2 Running pine-------- 2	Wintergreen---------- 6 Grass spp.----------- 4 Bedstraw/cleavers---- 2 Wild strawberry------ 2 Bramble spp.--------- 2
32B--------------- Kellogg	Sugar maple--------- 6 American beech------ 2 Hophornbeam--------- 2 American basswood--- 1 White ash----------- 1 Bigtooth aspen------ 1 Paper birch--------- 1 Yellow birch-------- 1 Black cherry-------- 1 Red maple----------- 1 Balsam fir---------- 1 Eastern hemlock----- 1	Red maple----------- 3 Balsam fir---------- 2 Eastern hemlock----- 1 White ash----------- 1 Yellow birch-------- 1	Serviceberry-------- 1 Red elderberry------ 1 Canada yew---------- 1	Bracken fern-------- 1 Shield fern--------- 1 Rattlesnake fern---- 1	Smooth yellow violet- 2 Grass spp.----------- 2 Currant/gooseberry--- 1 Partridgeberry------- 1 Sweet cicely--------- 1 Trillium spp.-------- 1 Wild leek------------ 1 Wintergreen---------- 1
35---------------- Kinross	Black spruce-------- 2 Tamarack------------ 2 Eastern white pine-- 1	Black spruce-------- 1 Tamarack------------ 1	Leatherleaf--------- 2 Speckled alder------ 1	---	Sphagnum moss-------- 5 Barren strawberry---- 2 Pale laurel---------- 2 Goldthread----------- 2 Twinflower----------- 2
47D--------------- Graycalm	Bigtooth aspen------ 5 Northern red oak---- 4 Red maple----------- 3 White oak----------- 2 Jack pine----------- 2 Paper birch--------- 1 Black cherry-------- 1 Eastern white pine-- 1 Red pine------------ 1	Red maple----------- 3 Northern red oak---- 2 White oak----------- 2 Bigtooth aspen------ 1	Serviceberry-------- 2 Witchhazel---------- 1	Bracken fern-------- 3 Shining clubmoss---- 2 Ground cedar-------- 1 Running pine-------- 1 Staghorn clubmoss--- 1 Stiff clubmoss------ 1 Ground pine--------- 1	Canada blueberry----- 4 Low bush blueberry--- 4 Sweetfern------------ 4 Grass spp.----------- 3 Wintergreen---------- 2 Bearberry------------ 2 Blue cladonia-------- 2 Bramble spp.--------- 2 Sedge spp.----------- 2 Trailing arbutus----- 2 Canada mayflower----- 1 Starflower----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
48B--------------- Rubicon-Graycalm	Jack pine----------- 5 Black cherry-------- 2 Northern red oak---- 2 White oak----------- 2 Red pine------------ 2 Eastern white pine-- 1	Jack pine----------- 2 Northern red oak---- 2 Black cherry-------- 1 White oak----------- 1 Red pine------------ 1 Eastern white pine-- 1	Hawthorne spp.------ 2	Bracken fern-------- 4	Grass spp.----------- 5 Hawkweed spp.-------- 4 Sedge spp.----------- 3 Sweetfern------------ 3 Low bush blueberry--- 2 Bramble spp.--------- 2
48D, 48E---------- Rubicon-Graycalm	Northern red oak---- 4 Red maple----------- 3 American beech------ 2 Bigtooth aspen------ 2 White oak----------- 2 White ash----------- 1 Paper birch--------- 1 Black cherry-------- 1 Chokecherry--------- 1 Eastern white pine-- 1 Sugar maple--------- 1	American beech------ 2 Black cherry-------- 2 Red maple----------- 2 Northern red oak---- 2 White oak----------- 2 White ash----------- 1 Paper birch--------- 1 Black cherry-------- 1 Chokecherry--------- 1 Sugar maple--------- 1 Eastern white pine-- 1	Serviceberry-------- 3 Beaked hazelnut----- 3 Mapleleaf viburnum-- 2 Witchhazel---------- 2	Bracken fern-------- 3	Low bush blueberry--- 3 Grass spp.----------- 3 Canada blueberry----- 2 Gay wings------------ 2 Sedge spp.----------- 2 Starflower----------- 2 Canada mayflower----- 2 Wintergreen---------- 2 Reindeer lichen------ 2 Rosey twisted stalk-- 1 Wild sarsaparilla---- 1 Wood bentony--------- 1 Wild strawberry------ 1 Bellwort spp.-------- 1 Bearberry------------ 1 Columbine------------ 1 Sweetfern------------ 1 Violet spp.---------- 1
49B, 49B3, 49C, 49D, 49E--------- Kalkaska	Sugar maple--------- 5 American beech------ 3 Black cherry-------- 3 Hophornbeam--------- 3 Eastern hemlock----- 2 Eastern white pine-- 2 Red maple----------- 1 Bigtooth aspen------ 1 Chokecherry--------- 1 Quaking aspen------- 1 Yellow birch-------- 1 Northern red oak---- 1 Red pine------------ 1	Sugar maple--------- 4 American beech------ 2 Black cherry-------- 1 Hophornbeam--------- 1 Eastern white pine-- 1 Yellow birch-------- 1	Serviceberry-------- 1 Witchhazel---------- 1	Bracken fern-------- 1 Shield fern--------- 1 Shining clubmoss---- 2 Ground pine--------- 1	Grass spp.----------- 3 Trout lily----------- 2 Trillium spp.-------- 2 Spring beauty-------- 1 Rosey twisted stalk-- 1 Wintergreen---------- 1 Wild sarsaparilla---- 1 Canada mayflower----- 1 Dutchman's breeches-- 1 Hawkweed spp.-------- 1 Sedge spp.----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
50B:					
Au Gres----------	Red maple---------- 3	Red maple---------- 3	Redosier dogwood---- 1	Bracken fern-------- 3	Low bush blueberry--- 4
	Balsam fir--------- 3	Balsam fir--------- 2	Speckled alder------ 1	Lady fern---------- 1	Bunchberry---------- 3
	Eastern white pine-- 3	Eastern white pine-- 1	Willow spp.--------- 1	Sensitive fern------ 1	Canada blueberry----- 3
	Bigtooth aspen------ 2	Paper birch--------- 1		Running pine-------- 2	Canada mayflower----- 2
	Quaking aspen------- 2	White spruce-------- 1		Ground cedar-------- 1	Wintergreen--------- 2
	Paper birch--------- 2			Shining clubmoss---- 1	Goldthread---------- 2
	Eastern hemlock----- 2			Staghorn clubmoss--- 1	Grass spp.---------- 2
	Yellow birch-------- 1			Stiff clubmoss------ 1	Sedge spp.---------- 2
	Sugar maple--------- 1			Ground pine--------- 1	Starflower---------- 2
	Northern white-cedar 1				Partridgeberry------- 1
	White spruce-------- 1				Bedstraw/cleavers---- 1
Kinross----------	Red maple---------- 4	Red maple---------- 2	Speckled alder------ 1	---	Sphagnum moss-------- 3
	Tamarack----------- 2	Black spruce-------- 1			Goldthread---------- 2
	Eastern white pine-- 1	Tamarack----------- 1			Miterwort spp.------- 2
	Black spruce-------- 1				Twinflower---------- 2
Croswell---------	Bigtooth aspen------ 5	Red maple---------- 3	Serviceberry-------- 1	Bracken fern-------- 4	Wintergreen--------- 4
	Red maple---------- 4	Eastern white pine-- 2	Witchhazel--------- 1	Running pine-------- 2	Canada blueberry----- 3
	Eastern white pine-- 3	Northern red oak---- 1		Ground cedar-------- 1	Grass spp.---------- 3
	Northern red oak---- 2	Black cherry-------- 1		Shining clubmoss---- 1	Low bush blueberry--- 2
	Quaking aspen------- 2	Balsam fir--------- 1			Sedge spp.---------- 2
	Jack pine---------- 2				Blue cladonia-------- 2
	Balsam fir--------- 2				Barren strawberry---- 2
	Black cherry-------- 1				Wild strawberry------ 1
	Red pine----------- 1				Bedstraw/cleavers---- 1
					Bramble spp.--------- 1
					Bunchberry---------- 1
					Starflower---------- 1
					Sweetfern----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
51---------------- Tawas-Leafriver	Northern white-cedar 4 Red maple----------- 3 Black ash----------- 2 Paper birch--------- 2 Yellow birch-------- 2 Balsam fir---------- 2 Eastern white pine-- 2 Black spruce-------- 1 Eastern hemlock----- 1	Northern white-cedar 2 Red maple----------- 2 Paper birch--------- 1 Yellow birch-------- 1 Balsam fir---------- 1	Speckled alder------ 2	Sensitive fern------ 1 Shield fern--------- 1 Lady fern----------- 1	Sedge spp.----------- 3 Sphagnum moss-------- 3 Bedstraw/cleavers---- 2 Dewberry spp.-------- 2 Goldthread----------- 2 Grass spp.----------- 2 Marsh marigold------- 2 Miterwort spp.------- 2 Starflower----------- 2 Yellow beadlily------ 1 Canada mayflower----- 1 Bunchberry----------- 1 Horsetail spp.------- 1 Indian pipe---------- 1 Jack-in-the-pulpit--- 1 Blue flag------------ 1 Jewelweed------------ 1 Joe-pye-weed spp.---- 1 Large leaf aster----- 1 Meadow-rue spp.------ 1 Mint spp.------------ 1 Stinging nettles----- 1 Orchid spp.---------- 1 Sweet coltsfoot------ 1 Twinflower----------- 1
53B, 53C---------- Negwegon	Sugar maple--------- 4 Hophornbeam--------- 3 American basswood--- 2 American beech------ 2 White ash----------- 2 Bigtooth aspen------ 2 Quaking aspen------- 2 Black cherry-------- 2 Paper birch--------- 1 Yellow birch-------- 1 Red maple----------- 1 Eastern hemlock----- 1 Eastern white pine-- 1	---	Hawthorne spp.------ 1 Serviceberry-------- 1 Red elderberry------ 1 American fly honeysuckle-------- 1 Mapleleaf viburnum-- 1	Bracken fern-------- 1 Lady fern----------- 1	Large leaf aster----- 2 Rosey twisted stalk-- 2 Wild strawberry------ 2 Trillium spp.-------- 2

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
54A---------------	Bigtooth aspen------ 4	Red maple----------- 2	Redosier dogwood---- 1	Bracken fern-------- 1	Sedge spp.----------- 3
Algonquin	Quaking aspen------- 3		Silky dogwood------- 1	Maidenhair fern----- 1	Goldenrod spp.------- 3
	Red maple----------- 3			Shield fern--------- 1	Wild strawberry------ 2
	Paper birch--------- 2			Lady fern----------- 1	Grass spp.----------- 2
	Balsam fir---------- 2				Large leaf aster----- 2
	Northern white-cedar 2				Partridgeberry------- 2
	Black ash----------- 1				Wild sarsaparilla---- 2
	Yellow birch-------- 1				Trillium spp.-------- 1
	Eastern hemlock----- 1				Bedstraw/cleavers---- 1
	Eastern white pine-- 1				Yellow beadlily------ 1
	White spruce-------- 1				Gay wings------------ 1
					Jack-in-the-pulpit--- 1
					Canada mayflower----- 1
					Spring beauty-------- 1
					Sweet cicely--------- 1
					Yellow lady's slipper 1
58A---------------	Balsam fir---------- 3	American basswood--- 1	Tag alder----------- 5	Sensitive fern------ 5	Bedstraw/cleavers---- 2
Wakeley-Allendale	Northern white-cedar 3	Bigtooth aspen------ 1	Alternate leaf	Lady fern----------- 2	Dewberry spp.-------- 2
	American basswood--- 2	Quaking aspen------- 1	dogwood------------ 3	Bracken fern-------- 1	Miterwort spp.------- 2
	Bigtooth aspen------ 2	Yellow birch-------- 1	Mapleleaf viburnum-- 2	Shining clubmoss---- 2	Partridgeberry------- 2
	Red maple----------- 2	Red maple----------- 1			Sedge spp.----------- 2
	Black spruce-------- 2	Balsam fir---------- 1			Black snakeroot------ 1
	Quaking aspen------- 1	Northern white-cedar 1			Jack-in-the-pulpit--- 1
	Yellow birch-------- 1	Black spruce-------- 1			Joe-pye-weed spp.---- 1
					Large leaf aster----- 1
					Nettle spp.---------- 1
					Sweet cicely--------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
75B, 75D, 75E-----	Northern red oak---- 5	Northern red oak---- 3	Witchhazel---------- 2	Bracken fern-------- 4	Wintergreen---------- 4
Rubicon	Red maple----------- 4	Red maple----------- 3		Tree clubmoss------- 2	Canada blueberry----- 3
	Jack pine----------- 3	Jack pine----------- 1			Low bush blueberry--- 3
	Bigtooth aspen------ 2	Eastern white pine-- 1			Sedge spp.----------- 2
	Quaking aspen------- 2	Red pine------------ 1			Sweetfern------------ 2
	White oak----------- 2				Bramble spp.--------- 2
	Eastern white pine-- 2				Grass spp.----------- 2
	Red pine------------ 2				Starflower----------- 1
	Paper birch--------- 1				Trailing arbutus----- 1
	Chokecherry--------- 1				Bearberry------------ 1
	White spruce-------- 1				Bedstraw/cleavers---- 1
					Blue cladonia-------- 1
					Hawkweed spp.-------- 1
					Reindeer lichen------ 1
					Rosey twisted stalk-- 1
81B---------------	Jack pine----------- 6	Jack pine----------- 3	Serviceberry-------- 1	Bracken fern-------- 2	Low bush blueberry--- 5
Grayling	Bigtooth aspen------ 2	Northern red oak---- 1			Canada blueberry----- 4
	Red maple----------- 2				Reindeer lichen------ 3
	Chokecherry--------- 1				Bearberry------------ 3
	Northern red oak---- 1				Blue cladonia-------- 3
	Eastern white pine-- 1				Wintergreen---------- 2
	Red pine------------ 1				Bramble spp.--------- 2
	Northern pin oak---- 1				Sedge spp.----------- 2
					Sweetfern------------ 2
					Trailing arbutus----- 2
					Grass spp.----------- 1
81D, 81E, 81F-----	Jack pine----------- 2	Northern red oak---- 2	Serviceberry-------- 1	Bracken fern-------- 2	Low bush blueberry--- 5
Grayling	Bigtooth aspen------ 2	Red maple----------- 2			Canada blueberry----- 4
	Quaking aspen------- 2				Reindeer lichen------ 3
	Red maple----------- 2				Bearberry------------ 3
	Chokecherry--------- 2				Blue cladonia-------- 3
	Pin cherry---------- 2				Wintergreen---------- 2
	Northern red oak---- 2				Bramble spp.--------- 2
	White oak----------- 1				Sedge spp.----------- 2
	Black cherry-------- 1				Sweetfern------------ 2
	Eastern white pine-- 1				Trailing arbutus----- 2
	Red pine------------ 1				Hawkweed spp.-------- 1
	Northern pin oak---- 1				Grass spp.----------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
86---------------- Histosols and Aquents	---	---	Speckled alder------ 4 Willow spp.--------- 3 Redosier dogwood---- 2	---	Sedge spp.----------- 3 Cattail spp.--------- 3 Grass spp.----------- 3
87---------------- Ausable	Northern white-cedar 4 Quaking aspen------- 3 Red maple----------- 2 Balsam fir---------- 2 Yellow birch-------- 1	Northern white-cedar 3 Red maple----------- 2 Yellow birch-------- 1 Balsam fir---------- 1	Speckled alder------ 4 Willow spp.--------- 2 Redosier dogwood---- 1	Lady fern----------- 1 Cinnamon fern------- 1 Bracken fern-------- 1	Sedge spp.----------- 5 Bunchberry----------- 2 Goldenrod spp.------- 2 Miterwort spp.------- 2 Meadow-rue spp.------ 1 Jewelweed------------ 1
99---------------- Roscommon	Bigtooth aspen------ 4 Red maple----------- 3 Balsam fir---------- 3 Northern white-cedar 3 Paper birch--------- 2 Black spruce-------- 2 Black ash----------- 2 White spruce-------- 1 Eastern white pine-- 1	Bigtooth aspen------ 2 Red maple----------- 2 Balsam fir---------- 2 Black ash----------- 1 Northern white-cedar 1 Black spruce-------- 1 White spruce-------- 1	Speckled alder------ 5 Willow spp.--------- 3 Redosier dogwood---- 2	Sensitive fern------ 4 Lady fern----------- 1 Ostrich fern-------- 1	Grass spp.----------- 4 Horsetail spp.------- 3 Miterwort spp.------- 3 Bramble spp.--------- 2 Dewberry spp.-------- 2 Sedge spp.----------- 2 Sphagnum moss spp.--- 1 Nettle spp.---------- 1 Violet spp.---------- 1
131E-------------- Rubicon-Menominee	Northern red oak---- 5 Red maple----------- 4 White oak----------- 3 Bigtooth aspen------ 2 Quaking aspen------- 2 Eastern white pine-- 2 Red pine------------ 2 Paper birch--------- 1 Chokecherry--------- 1 Sugar maple--------- 1 Eastern hemlock----- 1 Jack pine----------- 1 White spruce-------- 1	Northern red oak---- 2 Red maple----------- 2 Bigtooth aspen------ 1 Quaking aspen------- 1 Chokecherry--------- 1 Sugar maple--------- 1 Eastern hemlock----- 1 Jack pine----------- 1 White spruce-------- 1 Eastern white pine-- 1 Red pine------------ 1 Paper birch--------- 1 White oak----------- 1	Witchhazel---------- 2 Mapleleaf viburnum-- 1	Bracken fern-------- 3 Ground pine--------- 2	Wintergreen---------- 4 Canada blueberry----- 3 Low bush blueberry--- 3 Bramble spp.--------- 2 Grass spp.----------- 2 Sweetfern------------ 2 Bearberry------------ 1 Bedstraw/cleavers---- 1 Blue cladonia-------- 1 Hawkweed spp.-------- 1 Reindeer lichen------ 1 Rosey twisted stalk-- 1 Starflower----------- 1 Trailing arbutus----- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
147B, 147C, 147D,					
147E	Red maple----------- 5	Red maple----------- 3	Mapleleaf viburnum-- 2	Bracken fern-------- 3	Wintergreen---------- 4
Lindquist	Northern red oak---- 3	Northern red oak---- 2	Witchhazel---------- 2		Low bush blueberry--- 3
	Bigtooth aspen------ 3	Eastern white pine-- 1	Serviceberry-------- 1		Reindeer lichen------ 2
	Red pine------------ 2				Bedstraw/cleavers---- 2
	Quaking aspen------- 2				Canada blueberry----- 2
	Eastern white pine-- 2				Bramble spp.--------- 2
	Paper birch--------- 1				Partridgeberry------- 2
	Yellow birch-------- 1				Starflower----------- 2
	Sugar maple--------- 1				Trailing arbutus----- 2
	White oak----------- 1				Canada mayflower----- 2
	Balsam fir---------- 1				Wild strawberry------ 2
	Eastern hemlock----- 1				Wood bentony--------- 2
	American beech------ 1				Reindeer lichen------ 2
					Grass spp.----------- 2
					Rosey twisted stalk-- 1
159A	Red maple----------- 5	Red maple----------- 4	Redosier dogwood---- 3	Bracken fern-------- 2	Wintergreen---------- 5
Finch	Bigtooth aspen------ 3	Bigtooth aspen------ 2		Lady fern----------- 2	Starflower----------- 3
	Paper birch--------- 3	Paper birch--------- 1		Sensitive fern------ 1	Canada mayflower----- 3
	Balsam fir---------- 3	Balsam fir---------- 1		Ostrich fern-------- 1	Hepatica spp.-------- 2
	Northern white-cedar 3	Eastern hemlock----- 1		Shield fern--------- 1	Bunchberry----------- 2
	Eastern white pine-- 3	Northern white-cedar 1		Ground cedar-------- 2	Goldthread----------- 2
	Black spruce-------- 3	Eastern white pine-- 1		Shining clubmoss---- 2	Poison ivy----------- 1
	Eastern hemlock----- 2	Black spruce-------- 1		Ground pine--------- 1	Yellow beadlily------ 1
					Trailing arbutus----- 1
174A:					
Au Gres	Red maple----------- 3	Red maple----------- 3	Redosier dogwood---- 1	Bracken fern-------- 3	Low bush blueberry--- 4
	Balsam fir---------- 3	Balsam fir---------- 2	Speckled alder------ 1	Lady fern----------- 1	Bunchberry----------- 3
	Eastern white pine-- 3	Eastern white pine-- 1	Willow spp.--------- 1	Sensitive fern------ 1	Canada blueberry----- 3
	Bigtooth aspen------ 2	Paper birch--------- 1		Running pine-------- 2	Canada mayflower----- 2
	Quaking aspen------- 2	White spruce-------- 1		Ground cedar-------- 1	Wintergreen---------- 2
	Paper birch--------- 2			Shining clubmoss---- 1	Goldthread----------- 2
	Eastern hemlock----- 2			Staghorn clubmoss--- 1	Grass spp.----------- 2
	Yellow birch-------- 1			Stiff clubmoss------ 1	Sedge spp.----------- 2
	Sugar maple--------- 1			Ground pine--------- 1	Starflower----------- 2
	Northern white-cedar 1				Partridgeberry------- 1
	White spruce-------- 1				Bedstraw/cleavers---- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
174A: Roscommon	Bigtooth aspen------ 4	Bigtooth aspen------ 2	Speckled alder------ 5	Sensitive fern------ 4	Grass spp.----------- 4
	Red maple---------- 3	Red maple---------- 2	Willow spp.--------- 3	Lady fern---------- 1	Horsetail spp.------- 3
	Balsam fir--------- 3	Balsam fir--------- 2	Redosier dogwood---- 2	Ostrich fern-------- 1	Miterwort spp.------- 3
	Northern white-cedar 3	Black ash---------- 1			Bramble spp.--------- 2
	Paper birch--------- 2	Northern white-cedar 1			Dewberry spp.-------- 2
	Black spruce-------- 2	Black spruce-------- 1			Sedge spp.----------- 2
	Black ash---------- 2	White spruce-------- 1			Sphagnum moss spp.--- 1
	White spruce-------- 1				Nettle spp.---------- 1
	Eastern white pine-- 1				Violet spp.---------- 1
197A: Gladwin	Red maple---------- 3	Red maple---------- 3	Willow spp.--------- 2	Bracken fern-------- 3	Wintergreen---------- 2
	Bigtooth aspen------ 2	Bigtooth aspen------ 2	Redosier dogwood---- 1	Shield fern--------- 1	Bunchberry----------- 2
	Northern white-cedar 2	Balsam fir--------- 1			Grass spp.----------- 2
	White spruce-------- 1				Trillium spp.-------- 1
	Balsam fir--------- 1				Bedstraw/cleavers---- 1
					Twinflower----------- 1
338B, 338C, 338D, 338E: Islandlake	Sugar maple--------- 6	American beech------ 2	Witchhazel---------- 1	Bracken fern-------- 1	Trout lily----------- 2
	American beech------ 3	Hophornbeam--------- 2	Serviceberry-------- 1	Rattlesnake fern---- 1	Grass spp.----------- 2
	Hophornbeam--------- 3	Sugar maple--------- 2	Mapleleaf viburnum-- 1	Shield fern--------- 1	Bedstraw/cleavers---- 1
	American basswood--- 2	American basswood--- 1	Canada yew---------- 1	Ground pine--------- 1	Bramble spp.--------- 1
	Black cherry-------- 2	White ash---------- 1	Red elderberry------ 1	Running pine-------- 1	Currant/gooseberry--- 1
	White ash---------- 1	Bigtooth aspen------ 1		Shining clubmoss---- 1	Hepatica spp.-------- 1
	Bigtooth aspen------ 1	Paper birch--------- 1		Staghorn clubmoss--- 1	Indian pipe---------- 1
	Paper birch--------- 1	Yellow birch-------- 1		Stiff clubmoss------ 1	Partridgeberry------- 1
	Yellow birch-------- 1	Black cherry-------- 1		Ground cedar-------- 1	Reindeer lichen------ 1
	Red maple---------- 1	Red maple---------- 1			Spring beauty-------- 1
	Northern red oak---- 1	Northern red oak---- 1			Starflower----------- 1
	White oak---------- 1	White oak---------- 1			Sweet cicely--------- 1
	Eastern hemlock----- 1	Eastern hemlock----- 1			Trillium spp.-------- 1
	Eastern white pine-- 1	Eastern white pine-- 1			Canada white violet-- 1
	Red pine----------- 1	Red pine----------- 1			Wild leek------------ 1
					Smooth yellow violet- 1
					Wild sarsaparilla---- 1
					Canada mayflower----- 1
					Dutchman's breeches-- 1
					Herb Robert---------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
360	Red maple 3	Black ash 1	Tag alder 3	Shield fern 4	Grass spp. 3
Wakeley	Northern white-cedar 3	Bigtooth aspen 1	Redosier dogwood 2	Maidenhair fern 3	Sedge spp. 3
	Bigtooth aspen 2	Quaking aspen 1	Willow spp. 2	Interrupted fern 2	Bramble spp. 2
	Paper birch 2	Paper birch 1	Mapleleaf viburnum 1	Sensitive fern 2	Goldthread 2
	Balsam fir 2	Red maple 1		Lady fern 1	Miterwort spp. 2
	Eastern white pine 2	American elm 1			Sphagnum moss spp. 2
	White spruce 2	Balsam fir 1			Bugleweed 1
	Black ash 1	Eastern hemlock 1			Jack-in-the-pulpit 1
	Quaking aspen 1	Northern white-cedar 1			Jewelweed 1
	American elm 1	Eastern white pine 1			Nettle spp. 1
	Eastern hemlock 1	White spruce 1			
366B, 366C, 366D, 366E	Sugar maple 5	American beech 3	Mapleleaf viburnum 2	Bracken fern 2	Dutchman's breeches 3
Islandlake-Blue Lake	Bigtooth aspen 3	Hophornbeam 2	Witchhazel 1	Rattlesnake fern 1	Grass spp. 3
	American basswood 2	Red maple 2		Staghorn clubmoss 2	Trout lily 3
	American beech 2	Sugar maple 2		Ground pine 2	Starflower 2
	Quaking aspen 2	Eastern white pine 1		Running pine 2	Bedstraw/cleavers 2
	Hophornbeam 2	American basswood 1		Shining clubmoss 1	Canada mayflower 2
	Eastern white pine 2	Northern red oak 1		Ground cedar 1	Wild leek 2
	Red maple 1			Stiff clubmoss 1	Sedge spp. 2
	Northern red oak 1				Trillium spp. 2
	Eastern hemlock 1				Canada mayflower 2
					Wild sarsaparilla 1
					Wintergreen 1
					Bramble spp. 1
					Hepatica spp. 1
					Smooth yellow violet 1
371	Red maple 3	Black ash 1	Tag alder 3	Shield fern 4	Grass spp. 3
Springport	Northern white-cedar 3	Bigtooth aspen 1	Redosier dogwood 2	Maidenhair fern 3	Sedge spp. 3
	Bigtooth aspen 2	Quaking aspen 1	Willow spp. 2	Interrupted fern 2	Bramble spp. 2
	Paper birch 2	Paper birch 1	Mapleleaf viburnum 1	Sensitive fern 2	Goldthread 2
	Balsam fir 2	Red maple 1		Lady fern 1	Miterwort spp. 2
	Eastern white pine 2	American elm 1			Sphagnum moss spp. 2
	White spruce 2	Balsam fir 1			Bugleweed 1
	Black ash 1	Eastern hemlock 1			Jack-in-the-pulpit 1
	Quaking aspen 1	Northern white-cedar 1			Jewelweed 1
	American elm 1	Eastern white pine 1			Nettle spp. 1
	Eastern hemlock 1	White spruce 1			

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
402B, 402C: Islandlake	Sugar maple 6	Sugar maple 3	Mapleleaf viburnum 1	Shield fern 2	Trout lily 3
	Hophornbeam 3	American beech 2	Serviceberry 1	Bracken fern 2	Sweet cicely 2
	American basswood 2	American basswood 1	Witchhazel 1	Rattlesnake fern 1	Bramble spp. 2
	American beech 2	Black cherry 1	American fly honeysuckle 1	Ground pine 3	Grass spp. 2
	Yellow birch 2	Eastern hemlock 1		Ground cedar 1	Wild leek 2
	Black cherry 2	White ash 1		Running pine 1	Dutchman's breeches 2
	White ash 1	Bigtooth aspen 1		Shining clubmoss 1	Smooth yellow violet 2
	Paper birch 1	Paper birch 1		Staghorn clubmoss 1	Aster spp. 1
	Bigtooth aspen 1	Yellow birch 1		Stiff clubmoss 1	Bedstraw/cleavers 1
	Eastern hemlock 1	Hophornbeam 1			Currant/gooseberry 1
	Red maple 1	Red maple 1			Hepatica spp. 1
	Eastern white pine 1	Eastern white pine 1			Partridgeberry 1
					Rosey twisted stalk 1
					Spring beauty 1
					Downy yellow violet 1
					Canada mayflower 1
					Wild sarsaparilla 1
406A: Winterfield	Quaking aspen 3	Quaking aspen 1	Hawthorne spp. 2	Bracken fern 2	Bunchberry 3
	Red maple 2	Red maple 1	Witchhazel 1	Lady fern 1	Wintergreen 2
	Eastern white pine 1		Silky dogwood 1		Bedstraw/cleavers 2
	Paper birch 1		Speckled alder 1		Partridgeberry 1
			Willow spp. 1		
412A:					
Ingalls	Red maple 4	Red maple 3	Redosier dogwood 2	Lady fern 1	Grass spp. 3
	Bigtooth aspen 2	Bigtooth aspen 2	Speckled alder 1	Maidenhair fern 1	Sedge spp. 2
	Quaking aspen 2		Willow spp. 1	Shield fern 1	Bedstraw/cleavers 2
	Paper birch 2			Shining clubmoss 1	Bramble spp. 2
	Balsam fir 2				Partridgeberry 2
	Eastern hemlock 2				Goldthread 1
	Eastern white pine 2				Black snakeroot 1
	Northern white-cedar 2				Canada blueberry 1
	Black ash 1				Low bush blueberry 1
	Yellow birch 1				Twinflower 1
	Black cherry 1				Trillium spp. 1
	Hophornbeam 1				Canada mayflower 1
	Sugar maple 1				Wild sarsaparilla 1
	White spruce 1				Wintergreen 1
					Large leaf aster 1
					Sweet coltsfoot 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
412A:					
Burleigh---------	Red maple----------- 4	Red maple----------- 2	Speckled alder------ 3	Sensitive fern------ 3	Miterwort spp.------- 4
	Northern white-cedar 3	Bigtooth aspen------ 2	Redosier dogwood---- 2	Interrupted fern---- 2	Sedge spp.----------- 3
	Quaking aspen------- 2		Willow spp.--------- 2	Lady fern----------- 1	Dewberry spp.-------- 2
	American elm-------- 2				Goldthread----------- 2
	Black spruce-------- 1				Grass spp.----------- 2
	Black ash----------- 1				Sphagnum moss-------- 2
	Paper birch--------- 1				Bedstraw/cleaver----- 1
	Yellow birch-------- 1				Bugleweed------------ 1
	Balsam fir---------- 1				Bunchberry----------- 1
	Eastern hemlock----- 1				Jack-in-the-pulpit--- 1
	Eastern white pine-- 1				Jewelweed------------ 1
					Meadow-rue spp.------ 1
					Partridgeberry------- 1
					Stinging nettles----- 1
454B, 454C, 454D, 454E------------	Sugar maple--------- 6	Sugar maple--------- 3	Mapleleaf viburnum-- 2	Bracken fern-------- 1	Grass spp.----------- 3
Springlake	American basswood--- 2	Hophornbeam--------- 2	Witchhazel---------- 1	Maidenhair fern----- 1	Bedstraw/cleavers---- 2
	American beech------ 2	American basswood--- 1	Staghorn sumac------ 1	Rattlesnake fern---- 1	Bramble spp.--------- 2
	Quaking aspen------- 2	American beech------ 1		Shield fern--------- 1	Sedge spp.----------- 2
	Black cherry-------- 2	Bigtooth aspen------ 1		Shining clubmoss---- 1	Wild strawberry------ 2
	Hophornbeam--------- 2	Paper birch--------- 1		Stiff clubmoss------ 1	Bellwort spp.-------- 1
	White ash----------- 1	Black cherry-------- 1		Ground pine--------- 1	Currant/gooseberry--- 1
	Bigtooth aspen------ 1	American elm-------- 1			Large leaf aster----- 1
	Paper birch--------- 1	Eastern hemlock----- 1			Partridgeberry------- 1
	American elm-------- 1	Eastern white pine-- 1			Reindeer lichen------ 1
	Eastern hemlock----- 1	Jack pine----------- 1			Rosey twisted stalk-- 1
	Eastern white pine-- 1				Sweet cicely--------- 1
	Jack pine----------- 1				Trillium spp.-------- 1
					Trout lily----------- 1
					Twinflower----------- 1
					Downy yellow violet-- 1
					Smooth yellow violet- 1
					Wild leek------------ 1
					Canada mayflower----- 1
					Dutchman’s breeches-- 1
					Blue cohosh---------- 1
					Herb Robert---------- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
457B, 457C, 457D, 457E: Islandlake-Southwells	Sugar maple 6	Sugar maple 2	Mapleleaf viburnum 1	Bracken fern 2	Grass spp. 2
	American basswood 2	American basswood 1	Juniper spp. 1	Maidenhair fern 1	Trout lily 2
	American beech 2	American beech 1	Canada yew 1	Rattlesnake fern 1	Bedstraw/cleavers 1
	Hophornbeam 2	Hophornbeam 1		Shield fern 1	Bramble spp. 1
	White ash 1	White ash 1		Ground cedar 1	Hepatica spp. 1
	Bigtooth aspen 1	Bigtooth aspen 1		Running pine 1	Rosey twisted stalk 1
	Quaking aspen 1	Quaking aspen 1		Shining clubmoss 1	Starflower 1
	Paper birch 1	Paper birch 1		Staghorn clubmoss 1	Sweet cicely 1
	Yellow birch 1	Yellow birch 1		Stiff clubmoss 1	Trillium spp. 1
	Black cherry 1	Black cherry 1		Ground pine 1	Downy yellow violet 1
	Red maple 1	Red maple 1			Smooth yellow violet 1
	Northern red oak 1	Northern red oak 1			Wild leek 1
	Eastern hemlock 1	Eastern hemlock 1			Dutchman's breeches 1
	Eastern white pine 1	Eastern white pine 1			Herb Robert 1
	Red pine 1	Red pine 1			
458D: Islandlake-Menominee	Sugar maple 6	Sugar maple 2	Red elderberry 1	Bracken fern 2	Trout lily 2
	American basswood 2	Hophornbeam 2	American fly honeysuckle 1	Maidenhair fern 1	Bramble spp. 1
	White ash 2	American basswood 1	Mapleleaf viburnum 1	Rattlesnake fern 1	Currant/gooseberry 1
	Hophornbeam 2	American beech 1	Serviceberry 1	Shield fern 1	Dewberry spp. 1
	American beech 2	White ash 1	Witchhazel 1	Ground cedar 1	Grass spp. 1
	Yellow birch 1	Yellow birch 1		Running pine 1	Hepatica spp. 1
	Black cherry 1	Black cherry 1		Shining clubmoss 1	Large leaf aster 1
	Eastern hemlock 1	Eastern hemlock 1		Staghorn clubmoss 1	Partridgeberry 1
	Red pine 1	Red pine 1		Stiff clubmoss 1	Reindeer lichen 1
	Eastern white pine 1	Eastern white pine 1		Ground pine 1	Spring beauty 1
					Starflower 1
					Sweet cicely 1
					Trillium spp. 1
					Canada white violet 1
					Downy yellow violet 1
					Smooth yellow violet 1
					Wild leek 1
					Canada mayflower 1
					Wild sarsaparilla 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
459B, 459D, 459E--	Northern red oak---- 3	Red maple---------- 2	Mapleleaf viburnum-- 1	Bracken fern-------- 1	Canada blueberry----- 2
Rubicon	American beech------ 2	American beech------ 1	Witchhazel---------- 1	Ground cedar-------- 1	Low bush blueberry--- 2
	Bigtooth aspen------ 2	Bigtooth aspen------ 1		Running pine-------- 1	Bramble spp.--------- 2
	Red maple---------- 2	Quaking aspen------- 1		Shining clubmoss---- 1	Grass spp.----------- 2
	Sugar maple--------- 2	Sugar maple--------- 1		Staghorn clubmoss--- 1	Wintergreen---------- 2
	Eastern white pine-- 2	Northern red oak---- 1		Stiff clubmoss------ 1	Rosey twisted stalk-- 1
	Red pine----------- 2	Eastern hemlock----- 1		Ground pine--------- 1	Starflower----------- 1
	Quaking aspen------- 1	Eastern white pine-- 1			
	Eastern hemlock----- 1	Red pine----------- 1			
460B, 460C, 460D,					
460E, 460F-------	Sugar maple--------- 5	Sugar maple--------- 3	American fly	Bracken fern-------- 1	Grass spp.----------- 2
Rubicon-	American beech------ 3	American beech------ 1	honeysuckle-------- 1	Shield fern--------- 1	Bramble spp.--------- 1
Mancelona	American basswood--- 2	American basswood--- 1	Mapleleaf viburnum-- 1	Ground cedar-------- 1	Sweet cicely--------- 1
	Black cherry-------- 2	Black cherry-------- 1		Running pine-------- 1	Downy yellow violet-- 1
	Bigtooth aspen------ 1	Bigtooth aspen------ 1		Shining clubmoss---- 1	Smooth yellow violet- 1
	Hophornbeam--------- 1			Staghorn clubmoss--- 1	Wintergreen---------- 1
				Stiff clubmoss------ 1	
				Ground pine--------- 1	
461A:					
Allendale--------	Red maple---------- 5	Black ash---------- 1	---	Bracken fern-------- 1	Black snakeroot------ 1
	Sugar maple--------- 3	Green ash---------- 1		Lady fern---------- 1	Bunchberry---------- 1
	Eastern white pine-- 3	Bigtooth aspen------ 1		Maidenhair fern----- 1	Partridgeberry------- 1
	Paper birch--------- 2	Quaking aspen------- 1		Shield fern--------- 1	Sedge spp.----------- 1
	Yellow birch-------- 2	Paper birch--------- 1			Violet spp.---------- 1
	Balsam fir---------- 2	Yellow birch-------- 1			Canada mayflower----- 1
	Northern white-cedar 2	Red maple---------- 1			Yellow beadlily------ 1
	White spruce-------- 2	Sugar maple--------- 1			
	Black ash---------- 1				
	Green ash---------- 1				
	Bigtooth aspen------ 1				
	Quaking aspen------- 1				
	Eastern hemlock----- 1				

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
461A:					
Springport-------	Red maple---------- 3	Black ash---------- 1	Speckled alder------ 3	Shield fern--------- 4	Sedge spp.---------- 3
	Northern white-cedar 3	Bigtooth aspen------ 1	Redosier dogwood---- 2	Maidenhair fern----- 3	Grass spp.---------- 3
	Bigtooth aspen------ 2	Quaking aspen------- 1	Willow spp.--------- 2	Interrupted fern---- 2	Goldthread---------- 2
	Paper birch--------- 2	Paper birch--------- 1	Mapleleaf viburnum-- 1	Sensitive fern------ 2	Miterwort spp.------- 2
	Balsam fir---------- 2	Red maple---------- 1		Lady fern----------- 1	Sphagnum moss spp.--- 2
	Eastern white pine-- 2	American elm-------- 1			Bramble spp.--------- 1
	White spruce-------- 2	Balsam fir---------- 1			Bugleweed spp.------- 1
	Black ash---------- 1	Eastern hemlock----- 1			Jack-in-the-pulpit--- 1
	Quaking aspen------- 1	Northern white-cedar 1			Jewelweed----------- 1
	American elm-------- 1	Eastern white pine-- 1			Nettle spp.---------- 1
	Eastern hemlock----- 1	White spruce-------- 1			
462A-------------- Allendale- Algonquin	Quaking aspen------- 3	Quaking aspen------- 2	Mapleleaf viburnum-- 1	Bracken fern-------- 2	Grass spp.---------- 3
	Red maple---------- 3	American beech------ 1	Willow spp.--------- 1	Maidenhair fern----- 2	Wintergreen--------- 3
	Sugar maple--------- 3	White ash---------- 1		Shield fern--------- 2	Canada blueberry----- 2
	Black cherry-------- 2	American basswood--- 1		Shining clubmoss---- 2	Low bush blueberry--- 2
	Northern white-cedar 2	Yellow birch-------- 1		Staghorn clubmoss--- 2	Bunchberry---------- 2
	Eastern white pine-- 2	Hophornbeam--------- 1			Bellwort spp.-------- 1
	American basswood--- 1	Red maple---------- 1			Black snakeroot------ 1
	American beech------ 1	Sugar maple--------- 1			Bramble spp.--------- 1
	White ash---------- 1	Balsam fir---------- 1			Partridgeberry------- 1
	Yellow birch-------- 1	Eastern hemlock----- 1			Sedge spp.---------- 1
	Hophornbeam--------- 1	Northern white-cedar 1			Sweet cicely--------- 1
	Balsam fir---------- 1	W. white pine------- 1			Canada white violet-- 1
	Eastern hemlock----- 1	White spruce-------- 1			Canada mayflower----- 1
	White spruce-------- 1	Black cherry-------- 1			Wild sarsaparilla---- 1
					Blue cohosh---------- 1
466B-------------- Halfaday	Sugar maple--------- 4	Red maple---------- 5	Bracken fern-------- 2	---	Trout lily---------- 4
	Black cherry-------- 3	Sugar maple--------- 3	Shield fern--------- 2		Canada mayflower----- 3
	American beech------ 2	Black cherry-------- 2	Ground pine--------- 3		Starflower---------- 3
	Yellow birch-------- 2	American basswood--- 1	Stiff clubmoss------ 2		Grass spp.---------- 3
	Red maple---------- 2	American beech------ 1			Rosey twisted stalk-- 2
	Eastern hemlock----- 2	Paper birch--------- 1			Downy yellow violet-- 2
	Bigtooth aspen------ 1	Yellow birch-------- 1			Dutchman's breeches-- 2
	Quaking aspen------- 1	Eastern hemlock----- 1			Bellwort spp.-------- 1
	Paper birch--------- 1	Eastern white pine-- 1			Sedge spp.---------- 1
	Hophornbeam--------- 1				Sweet cicely--------- 1
	American basswood--- 1				
	Eastern white pine-- 1				

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
467B, 467C-------- Morganlake- Woodman- Blue Lake	Sugar maple--------- 5 American beech------ 3 American basswood--- 3 Black cherry-------- 2 Hophornbeam--------- 2 White ash---------- 2 Yellow birch-------- 1	Sugar maple--------- 3 American beech------ 2 Hophornbeam--------- 2 White ash---------- 1 American basswood--- 1 Black cherry-------- 1	Mapleleaf viburnum-- 1	Bracken fern-------- 2 Maidenhair fern----- 1 Shield fern--------- 1 Ground cedar-------- 1 Stiff clubmoss------ 1	Sweet cicely--------- 4 Bedstraw/cleavers---- 3 Downy yellow violet-- 3 Wild leek----------- 3 Starflower---------- 3 Trout lily---------- 2 Rosey twisted stalk-- 2 Ditchman's breeches-- 2 Trillium spp.-------- 2 Grass spp.---------- 2 Canada white violet-- 1 Bellwort spp.-------- 1
468F------------- Southwells- Mancelona- Dighton	Sugar maple--------- 5 American beech------ 3 American basswood--- 2 White ash---------- 2 Hophornbeam--------- 2 Yellow birch-------- 1 Black cherry-------- 1	Sugar maple--------- 2 Hophornbeam--------- 2 American basswood--- 1 American beech------ 1 White ash---------- 1 Yellow birch-------- 1 Black cherry-------- 1	American fly honeysuckle-------- 1 Witchhazel--------- 1	Bracken fern-------- 2 Rattlesnake fern---- 1 Shield fern--------- 1 Ground cedar-------- 1 Running pine-------- 1 Ground pine--------- 1	Wild leek----------- 3 Grass spp.---------- 2 Trout lily---------- 2 Starflower---------- 2 Sweet cicely--------- 2 Downy yellow violet-- 2 Dutchman's breeches-- 2 Bedstraw/cleavers---- 1 Hepatica spp.-------- 1 Trillium spp.-------- 1 Herb Robert--------- 1
469B------------- Hodenpyl-Montcalm	Sugar maple--------- 4 American beech------ 2 Hophornbeam--------- 2 American basswood--- 1 White ash---------- 1 Eastern hemlock----- 1 Eastern white pine-- 1	Sugar maple--------- 2 Hophornbeam--------- 2 American basswood--- 1	Mapleleaf viburnum-- 1 Witchhazel--------- 1	Bracken fern-------- 2 Shield fern--------- 1 Maidenhair fern----- 1 Shining clubmoss---- 1 Ground pine--------- 1	Grass spp.---------- 2 Sweet cicely--------- 2 Trillium spp.-------- 2 Wild leek----------- 2 Bedstraw/cleavers---- 2 Smooth yellow violet- 1 Canada white violet-- 1 Herb Robert--------- 1 Currant/gooseberry--- 1 Horsetail----------- 1
471B------------- Mancelona- Blue Lake	Sugar maple--------- 5 Hophornbeam--------- 2 American basswood--- 2 American beech------ 2 Yellow birch-------- 1 Black cherry-------- 1	Sugar maple--------- 2 American beech------ 2 Hophornbeam--------- 1 Black cherry-------- 1	Mapleleaf viburnum-- 2 Witchhazel--------- 1	Bracken fern-------- 2 Rattlesnake fern---- 1 Ground pine--------- 2 Running pine-------- 2 Ground cedar-------- 1	Grass spp.---------- 2 Sweet cicely--------- 2 Downy yellow violet-- 2 Bramble spp.-------- 1 Smooth yellow violet- 1

Table 9.—Soils and Associated Plant Communities—Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
472B-------------- Morganlake	Sugar maple--------- 4	Sugar maple--------- 3	Mapleleaf viburnum-- 1	Bracken fern-------- 2	Spring beauty-------- 3
	American beech------ 3	American beech------ 2		Shield fern--------- 1	Sweet cicely--------- 2
	Black cherry-------- 2	Black cherry-------- 1		Ground cedar-------- 1	Dutchman's breeches-- 2
	Hophornbeam--------- 2	American basswood--- 1		Stiff clubmoss------ 1	Wild leek----------- 1
	Bigtooth aspen------ 1				Bedstraw/cleavers---- 1
	Yellow birch-------- 1				Rosey twisted stalk-- 1
					Downy yellow violet-- 1
488A-------------- Allendale	Red maple----------- 5	Black ash----------- 1	---	Bracken fern-------- 1	Black snakeroot------ 1
	Sugar maple--------- 3	Green ash----------- 1		Lady fern----------- 1	Bunchberry----------- 1
	Eastern white pine-- 3	Bigtooth aspen------ 1		Maidenhair fern----- 1	Partridgeberry------- 1
	Paper birch--------- 2	Quaking aspen------- 1		Shield fern--------- 1	Sedge spp.----------- 1
	Yellow birch-------- 2	Paper birch--------- 1			Violet spp.---------- 1
	Balsam fir---------- 2	Yellow birch-------- 1			Canada mayflower----- 1
	Northern white-cedar 2	Red maple----------- 1			Yellow beadlily------ 1
	White spruce-------- 2	Sugar maple--------- 1			
	Black ash----------- 1				
	Green ash----------- 1				
	Bigtooth aspen------ 1				
	Quaking aspen------- 1				
	Eastern hemlock----- 1				
494--------------- Gauld	Red maple----------- 4	Red maple----------- 2	Speckled alder------ 3	Interrupted fern---- 3	Miterwort spp.------- 4
	Quaking aspen------- 2	Quaking aspen------- 2	Willow spp.--------- 2	Lady fern----------- 1	Sedge spp.----------- 3
	Paper birch--------- 1		Redosier dogwood---- 1		Dewberry spp.-------- 2
	Northern white-cedar 1				Bunchberry----------- 2
					Sphagnum moss-------- 2
					Jack-in-the-pulpit--- 1
					Stinging nettles----- 1

Table 10.—Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
13:					
Tawas	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
Lupton	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
14:					
Dawson	common ninebark, gray dogwood, silky dogwood	American cranberrybush, nannyberry	black spruce, eastern white pine	---	---
Loxley	common ninebark, gray dogwood, silky dogwood	American cranberrybush, nannyberry	black spruce, eastern white pine	---	---
15A:					
Croswell	---	common lilac, eastern redcedar	jack pine, red pine	eastern white pine	---
Au Gres	common ninebark	American cranberrybush, nannyberry	jack pine, white spruce	eastern white pine, green ash	---
16B, 16E:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
17A:					
Croswell	---	---	jack pine, red pine	eastern white pine	---
18A:					
Au Gres	common ninebark	American cranberrybush, nannyberry	jack pine, white spruce	eastern white pine, green ash	---
19:					
Leafriver	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
20B:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
Grayling	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
20D:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
Grayling	silver buffaloberry, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
20F:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
Grayling	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
21B:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
Klacking	---	nannyberry	white spruce	eastern white pine, red pine	---
21D:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
Klacking	---	---	white spruce	eastern white pine, red pine	---
21F:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
Klacking	---	nannyberry	white spruce	eastern white pine, red pine	---
22B:					
Montcalm	---	---	white spruce	eastern white pine, jack pine, red pine	---
23:					
Ausable	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
Bowstring	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
24A:					
Kinross	common ninebark	American cranberrybush, nannyberry	black spruce	jack pine, eastern white pine	---
Au Gres	common ninebark	American cranberrybush, nannyberry	white spruce	jack pine, eastern white pine, green ash	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
26B:					
Cublake	buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
28B:					
East Lake	---	---	jack pine, red pine	eastern white pine	---
32B:					
Kellogg	American cranberrybush, silky dogwood	---	white spruce	eastern white pine, red pine	---
35:					
Kinross	common ninebark	American cranberrybush, nannyberry	black spruce	jack pine, eastern white pine	---
47D:					
Graycalm	---	---	jack pine, red pine	eastern white pine	---
48B, 48D:					
Rubicon	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Graycalm	---	---	jack pine, red pine	eastern white pine	---
48E:					
Rubicon	smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Graycalm	---	---	jack pine, red pine	eastern white pine	---
49B, 49B3, 49C, 49D, 49E:					
Kalkaska	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
50B:					
Au Gres	common ninebark	American cranberrybush	white spruce	jack pine, eastern white pine, green ash	---
Kinross	common ninebark	American cranberrybush, nannyberry	black spruce	jack pine, eastern white pine, green ash	---
Croswell	---	---	jack pine, red pine	eastern white pine	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
51:					
Tawas-------------	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
Leafriver---------	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
53B:					
Negwegon----------	silky dogwood	---	white spruce	green ash, red pine, eastern white pine	---
53C:					
Negwegon----------	silky dogwood	common lilac	white spruce	green ash, red pine, eastern white pine	---
54A:					
Algonquin---------	silky dogwood	American cranberrybush	white spruce	green ash, eastern white pine	---
58A:					
Wakeley-----------	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
Allendale---------	---	American cranberrybush, nannyberry, northern white-cedar	white spruce	eastern white pine, red maple	---
75B, 75D, 75E:					
Rubicon-----------	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
78.					
Pits, borrow					
81B, 81D, 81E, 81F:					
Grayling----------	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
83B, 83F.					
Udipsamments					
86.					
Histosols and Aquents					

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
87:					
Ausable	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
99:					
Roscommon	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
131E:					
Rubicon	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Menominee	---	nannyberry	white spruce	eastern white pine, green ash, red pine	---
147B, 147C, 147D, 147E:					
Lindquist	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
159A:					
Finch	common ninebark, silky dogwood	American cranberrybush, nannyberry	---	jack pine, white spruce, eastern white pine, green ash	---
174A:					
Au Gres	common ninebark	American cranberrybush, nannyberry	jack pine, white spruce	eastern white pine, green ash	---
Roscommon	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
197A:					
Gladwin	silky dogwood	nannyberry, northern white-cedar	white spruce	eastern white pine, green ash	---
338B:					
Islandlake	smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
338C, 338D, 338E:					
Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
360:					
Wakeley	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
366B:					
Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Blue Lake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
366C:					
Islandlake	common lilac, silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Blue Lake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
366D:					
Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Blue Lake	silver buffaloberry, smooth sumac, staghorn sumac	eastern redcedar	jack pine, red pine, eastern white pine	---	---
366E:					
Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Blue Lake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
371:					
Springport	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
380. Acess denied					
402B, 402C: Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
406A: Winterfield	common ninebark, silky dogwood	American cranberrybush, nannyberry	white spruce	eastern white pine, green ash	---
412A: Ingalls	American cranberrybush, common ninebark	northern white-cedar	white spruce	eastern white pine, green ash	---
Burleigh	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
454B, 454C, 454D, 454E: Springlake	buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
457B, 457C, 457D, 457E: Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Southwells	silky dogwood	nannyberry	white spruce	eastern white pine, red pine	---
458D: Islandlake	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Menominee	---	nannyberry	white spruce	eastern white pine, green ash, red pine	---
459B, 459D, 459E: Rubicon	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
460B, 460C, 460D, 460E, 460F:					
Rubicon----------	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
Mancelona--------	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
461A:					
Allendale---------	---	nannyberry	white spruce	eastern white pine, red maple	---
Springport--------	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
462A:					
Allendale---------	---	American cranberrybush, nannyberry, northern white-cedar	white spruce	eastern white pine, red maple	---
Algonquin---------	silky dogwood	American cranberrybush	white spruce	green ash, eastern white pine	---
466B:					
Halfaday----------	buffaloberry, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
467B, 467C:					
Morganlake--------	American cranberrybush	nannyberry	white spruce	eastern white pine, green ash	---
Woodman-----------	silky dogwood	nannyberry	white spruce	green ash, red pine, eastern white pine	---
Blue Lake---------	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
468F:					
Southwells--------	silky dogwood	nannyberry	white spruce	eastern white pine, red pine	---
Mancelona---------	---	---	white spruce	eastern white pine, jack pine, red pine	---
Dighton-----------	silky dogwood	nannyberry	white spruce	green ash, red pine, eastern white pine	---

Table 10.—Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
469B:					
Hodenpyl----------	---	---	white spruce	eastern white pine, red pine	---
Montcalm----------	---	---	white spruce	eastern white pine, jack pine, red pine	---
471B:					
Mancelona---------	---	eastern redcedar	white spruce	eastern white pine, jack pine, red pine	---
Blue Lake---------	silver buffaloberry, smooth sumac, staghorn sumac	---	jack pine, red pine, eastern white pine	---	---
472B:					
Morganlake--------	American cranberrybush	nannyberry	white spruce	eastern white pine, green ash	---
488A:					
Allendale---------	---	American cranberrybush, nannyberry, northern white-cedar	white spruce	eastern white pine, red maple	---
494:					
Gauld-------------	common ninebark, redosier dogwood, silky dogwood	nannyberry, black spruce	northern white-cedar, green ash	---	---
W.					
Water					

Table 11.—Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
13:					
Tawas	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Lupton	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
14:					
Dawson	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Loxley	Severe: excess humus, ponding, too acid.	Severe: excess humus, ponding, too acid.	Severe: excess humus, ponding, too acid.	Severe: excess humus, ponding.	Severe: excess humus, ponding, too acid.
15A:					
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
16B:					
Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
16E:					
Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
17A:					
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
18A:					
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
19:					
Leafriver	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
20B:					
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Grayling-------	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
20D:					
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Grayling-------	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
20F:					
Graycalm-------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
Grayling-------	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope, too acid.
21B:					
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Klacking-------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
21D:					
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Klacking-------	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
21F:					
Graycalm-------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
Klacking-------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
22B:					
Montcalm-------	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
23:					
Ausable--------	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.
Bowstring------	Severe: excess humus, flooding, wetness.	Severe: excess humus, wetness.	Severe: excess humus, flooding, wetness.	Severe: excess humus, wetness.	Severe: excess humus, flooding, wetness.
24A:					
Kinross--------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
Au Gres--------	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
26B:					
Cublake--------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
28B:					
East Lake------	Severe: too sandy.	Severe: too sandy.	Moderate: slope, small stones.	Severe: too sandy.	Moderate: droughty, large stones.
32B:					
Kellogg--------	Severe: percs slowly, too sandy.	Severe: percs slowly, too sandy.	Severe: percs slowly, too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
35:					
Kinross--------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
47D:					
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
48B:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
48D:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Graycalm-------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
48E:					
Rubicon--------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
Graycalm-------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
49B, 49B3:					
Kalkaska-------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
49C:					
Kalkaska-------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
49D:					
Kalkaska-------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
49E:					
Kalkaska-------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
50B:					
Au Gres--------	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
Kinross--------	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.
Croswell-------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
51:					
Tawas----------	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Leafriver------	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
53B:					
Negwegon-------	Severe: wetness.	Moderate: percs slowly, wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
53C:					
Negwegon-------	Severe: wetness.	Moderate: percs slowly, slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: slope, wetness.
54A:					
Algonquin------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
58A:					
Wakeley--------	Severe: percs slowly, ponding.	Severe: percs slowly, ponding, too sandy.	Severe: percs slowly, ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.
Allendale------	Severe: percs slowly, wetness.	Severe: percs slowly, wetness.	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.
75B:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
75D:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
75E:					
Rubicon--------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
78.					
Pits, borrow					
81B:					
Grayling-------	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
81D:					
Grayling-------	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
81E, 81F:					
Grayling-------	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope, too acid.
83B:					
Udipsamments---	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
83F:					
Udipsamments---	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
86:					
Histosols------	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Aquents--------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
87:					
Ausable--------	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.
99:					
Roscommon------	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.
131E:					
Rubicon--------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Menominee------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, small stones, too sandy.	Severe: slope, too sandy.	Severe: slope.
147B:					
Lindquist------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
147C, 147D:					
Lindquist------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
147E:					
Lindquist------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
159A:					
Finch----------	Severe: cemented pan, too sandy, wetness.	Severe: cemented pan, too sandy, wetness.	Severe: cemented pan, too sandy, wetness.	Severe: too sandy, wetness.	Severe: cemented pan, droughty, wetness.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
174A:					
Au Gres--------	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
Roscommon------	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.
197A:					
Gladwin--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
338B:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
338C:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
338D:					
Islandlake-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
338E:					
Islandlake-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
360:					
Wakeley--------	Severe: excess humus, percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: ponding.	Severe: excess humus, ponding.
366B:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Blue Lake------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
366C, 366D:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
Blue Lake------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
366E:					
Islandlake-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Moderate: slope.
Blue Lake------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
371:					
Springport-----	Severe: percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding.
380. Access denied					
402B:					
Islandlake-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
402C:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Moderate: too sandy.	Moderate: droughty, slope, too sandy.
406A:					
Winterfield----	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
412A:					
Ingalls--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Burleigh-------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
454B:					
Springlake-----	Slight----------	Slight----------	Moderate: slope, small stones.	Severe: too sandy.	Severe: droughty.
454C, 454D:					
Springlake-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
454E:					
Springlake-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
457B:					
Islandlake-----	Severe: poor filter.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Southwells-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
457C:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Moderate: too sandy.	Moderate: droughty, slope, too sandy.
Southwells-----	Moderate: slope, too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
457D:					
Islandlake-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Southwells-----	Severe: too sandy.	Moderate: slope, too sandy.	Severe: slope.	Severe: too sandy.	Moderate: droughty, slope.
457E:					
Islandlake-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Southwells-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
458D:					
Islandlake-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
Menominee------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
459B, 459D:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
459E:					
Rubicon--------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
460B:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Mancelona------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, large stones.
460C:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Mancelona------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, large stones, slope.
460D:					
Rubicon--------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Mancelona------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
460E, 460F:					
Rubicon--------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
Mancelona------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
461A:					
Allendale------	Severe: percs slowly, wetness.	Severe: percs slowly, wetness.	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.
Springport-----	Severe: percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding.
462A:					
Allendale------	Severe: percs slowly, wetness.	Severe: percs slowly, wetness.	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.
Algonquin------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
466B:					
Halfaday-------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
467B:					
Morganlake-----	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid.
Woodman--------	Severe: wetness.	Moderate: percs slowly, wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Blue Lake------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
467C:					
Morganlake-----	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Moderate: too sandy.	Severe: too acid.
Woodman--------	Severe: wetness.	Moderate: percs slowly, slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: slope, wetness.
Blue Lake------	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
468F:					
Southwells-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Mancelona------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Dighton--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily, slope.	Moderate: slope.
469B:					
Hodenpyl-------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Montcalm-------	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.
471B:					
Mancelona------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, large stones.
Blue Lake------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
472B:					
Morganlake-----	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid.

Table 11.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
488A:					
Allendale------	Severe: percs slowly, too sandy, wetness.	Severe: percs slowly, too sandy, wetness.	Severe: percs slowly, too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
494:					
Gauld----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
W.					
Water					

Table 12.—Wildlife Habitat

(Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
13:										
Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
Lupton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
14:										
Dawson	Very poor	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair
Loxley	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
15A:										
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor
16B:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
16E:										
Graycalm	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Very poor	Good	Very poor
17A:										
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
18A:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor
19:										
Leafriver	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
20B:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Grayling	Poor	Poor	Fair	Poor	Poor	Poor	Very poor	Poor	Poor	Very poor
20D:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Grayling	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
20F:										
Graycalm-----	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Very poor	Good	Very poor
Grayling-----	Very poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
21B:										
Graycalm-----	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Klacking-----	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor
21D:										
Graycalm-----	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Klacking-----	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
21F:										
Graycalm-----	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Very poor	Good	Very poor
Klacking-----	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
22B:										
Montcalm-----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
23:										
Ausable------	Very poor	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair
Bowstring----	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
24A:										
Kinross------	Very poor	Poor	Poor	Fair	Fair	Good	Good	Very poor	Fair	Good
Au Gres------	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor
26B:										
Cublake------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
28B:										
East Lake----	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
32B:										
Kellogg------	Fair	Fair	Good	Good	Good	Poor	Very poor	Fair	Good	Very poor

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
35:										
Kinross	Very poor	Poor	Poor	Fair	Fair	Good	Good	Very poor	Fair	Good
47D:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
48B:										
Rubicon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
Graycalm	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
48D:										
Rubicon	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
Graycalm	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
48E:										
Rubicon	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
Graycalm	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Very poor	Good	Very poor
49B, 49B3:										
Kalkaska	Fair	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
49C, 49D:										
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
49E:										
Kalkaska	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
50B:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor
Kinross	Very poor	Poor	Poor	Fair	Fair	Good	Good	Very poor	Fair	Good
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
51:										
Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
Leafriver	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good
53B:										
Negwegon	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
53C:										
Negwegon-----	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
54A:										
Algonquin----	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair
58A:										
Wakeley------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good
Allendale----	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor
75B:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
75D:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
75E:										
Rubicon------	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
78. Pits, borrow										
81B:										
Grayling-----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor	Poor	Poor	Very poor
81D:										
Grayling-----	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
81E, 81F:										
Grayling-----	Very poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
83B, 83F. Udipsamments										
86. Histosols and Aquents										
87:										
Ausable------	Very poor	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair
99:										
Roscommon----	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good
131E:										
Rubicon------	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
Menominee----	Poor	Poor	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
147B, 147C, 147D:										
Lindquist---	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
147E:										
Lindquist----	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
159A:										
Finch--------	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor
174A:										
Au Gres------	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor
Roscommon----	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good
197A:										
Gladwin------	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor
338B:										
Islandlake---	Fair	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
338C, 338D:										
Islandlake---	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
338E:										
Islandlake---	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
360:										
Wakeley------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good
366B:										
Islandlake---	Fair	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Blue Lake----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
366C, 366D:										
Islandlake---	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Blue Lake----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
366E:										
Islandlake---	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Blue Lake----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
371:										
Springport---	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
380. Access denied										
402B: Islandlake---	Fair	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
402C: Islandlake---	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
406A: Winterfield--	Poor	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
412A: Ingalls------	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair
Burleigh-----	Very poor	Very poor	Fair	Fair	Fair	Good	Good	Very poor	Fair	Good
454B, 454C, 454D: Springlake--	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Fair	Very poor
454E: Springlake---	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
457B: Islandlake---	Fair	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Southwells---	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
457C: Islandlake---	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Southwells---	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
457D: Islandlake---	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Southwells---	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
457E: Islandlake---	Very poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Southwells---	Very poor	Poor	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
458D:										
Islandlake---	Poor	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Menominee----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
459B:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
459D:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
459E:										
Rubicon------	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
460B:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
Mancelona----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
460C:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
Mancelona----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
460D:										
Rubicon------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor
Mancelona----	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
460E, 460F:										
Rubicon------	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor
Mancelona----	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
461A:										
Allendale----	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor
Springport---	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good
462A:										
Allendale----	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor
Algonquin----	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair
466B:										
Halfaday-----	Fair	Fair	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor

Table 12.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
467B:										
Morganlake---	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Woodman------	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Blue Lake----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
467C:										
Morganlake---	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Woodman------	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
Blue Lake----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
468F:										
Southwells---	Very poor	Poor	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Mancelona----	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Dighton------	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor
469B:										
Hodenpyl-----	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Montcalm-----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
471B:										
Mancelona----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Blue Lake----	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
472B:										
Morganlake---	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
488A:										
Allendale----	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor
494:										
Gauld--------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good
W.										
Water										

Table 13.—Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
13:						
Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
Lupton	Severe: excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
14:						
Dawson	Severe: cutbanks cave, excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
Loxley	Severe: excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding, too acid.
15A:						
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
16B:						
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
16E:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
17A:						
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
18A:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
19:						
Leafriver	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: excess humus, ponding.
20B:						
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty, too acid.
20D:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty, too acid.
20F:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope, too acid.
21B:						
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Klacking	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
21D:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Klacking	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
21F:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Klacking	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
22B:						
Montcalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
23:						
Ausable	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: excess humus, flooding, ponding.
Bowstring	Severe: cutbanks cave, excess humus, wetness.	Severe: flooding, subsides, wetness.	Severe: flooding, subsides, wetness.	Severe: flooding, subsides, wetness.	Severe: flooding, subsides, wetness.	Severe: excess humus, flooding, wetness.
24A:						
Kinross	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
26B:						
Cublake	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: droughty.
28B:						
East Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
32B:						
Kellogg	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Slight	Moderate: droughty, too sandy.
35:						
Kinross	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
47D:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
48B:						
Rubicon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
48D:						
Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
48E:						
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
49B, 49B3:						
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
49C:						
Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
49D, 49E:						
Kalkaska-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
50B:						
Au Gres------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Kinross------------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Croswell-----------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
51:						
Tawas--------------	Severe: cutbanks cave, excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
Leafriver----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: excess humus, ponding.
53B:						
Negwegon-----------	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.	Moderate: wetness.
53C:						
Negwegon-----------	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope, wetness.	Severe: low strength, shrink-swell.	Moderate: slope, wetness.
54A:						
Algonquin----------	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell, wetness.	Severe: wetness.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
58A:						
Wakeley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
75B:						
Rubicon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
75D:						
Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
75E:						
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
78.						
Pits, borrow						
81B:						
Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty, too acid.
81D:						
Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty, too acid.
81E, 81F:						
Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope, too acid.
83B:						
Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
83F:						
Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
86:						
Histosols	Severe: excess humus, ponding.	Severe: low strength, ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: frost action, ponding.	Severe: excess humus, ponding.
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
87:						
Ausable	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: excess humus, flooding, ponding.
99:						
Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
131E:						
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Menominee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
147B:						
Lindquist	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
147C, 147D:						
Lindquist	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
147E:						
Lindquist	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
159A:						
Finch	Severe: cemented pan, cutbanks cave, wetness.	Severe: wetness.	Severe: cemented pan, wetness.	Severe: wetness.	Severe: wetness.	Severe: cemented pan, droughty, wetness.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
174A:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
197A:						
Gladwin	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
338B:						
Islandlake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
338C:						
Islandlake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
338D, 338E:						
Islandlake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
360:						
Wakeley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
366B:						
Islandlake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Blue Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
366C, 366D:						
Islandlake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
366C, 366D:						
Blue Lake----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
366E:						
Islandlake---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Blue Lake----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
371:						
Springport---------	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
380.						
Access denied						
402B:						
Islandlake---------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
402C:						
Islandlake---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
406A:						
Winterfield--------	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
412A:						
Ingalls------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Burleigh-----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
454B:						
Springlake---------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
454C, 454D:						
Springlake---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
454E:						
Springlake---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
457B:						
Islandlake---------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty, too sandy.
Southwells---------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
457C:						
Islandlake---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Southwells---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
457D:						
Islandlake---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, too sandy.
Southwells---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
457E:						
Islandlake---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Southwells---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
458D:						
Islandlake---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
458D:						
Menominee----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
459B:						
Rubicon------------	Severe: cutbanks cave.	Slight: slope.	Slight: slope.	Slight: slope.	Slight: slope.	Severe: droughty.
459D:						
Rubicon------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
459E:						
Rubicon------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
460B:						
Rubicon------------	Severe: cutbanks cave.	Slight: slope.	Slight: slope.	Slight: slope.	Slight: slope.	Severe: droughty.
Mancelona----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, large stones.
460C:						
Rubicon------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Mancelona----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.
460D:						
Rubicon------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Mancelona----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
460E, 460F:						
Rubicon------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
460E, 460F:						
Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
461A:						
Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Springport	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
462A:						
Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Algonquin	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell, wetness.	Severe: wetness.
466B:						
Halfaday	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
467B:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell, wetness.	Severe: too acid.
Woodman	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.	Moderate: wetness.
Blue Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
467C:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: shrink-swell, slope, wetness.	Severe: too acid.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
467C:						
Woodman	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope, wetness.	Severe: low strength, shrink-swell.	Moderate: slope, wetness.
Blue Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
468F:						
Southwells	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Dighton	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell, slope.	Moderate: slope.
469B:						
Hodenpyl	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Montcalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
471B:						
Mancelona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
Blue Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
472B:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell, wetness.	Severe: too acid.
488A:						
Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Table 13.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
494:						
Gauld	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
W.						
Water						

Table 14.—Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13:					
Tawas--------	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Lupton-------	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage.	Poor: excess humus, ponding.
14:					
Dawson-------	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage.	Poor: excess humus, ponding.
Loxley-------	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage.	Poor: excess humus, ponding, too acid.
15A:					
Croswell-----	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Au Gres------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
16B:					
Graycalm-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
16E:					
Graycalm-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
17A:					
Croswell-----	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
18A:					
Au Gres------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
19:					
Leafriver----	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
20B:					
Graycalm-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Grayling-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20D:					
Graycalm-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Grayling-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20F:					
Graycalm-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Grayling-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
21B:					
Graycalm-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Klacking-----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
21D:					
Graycalm-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Klacking-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
21F:					
Graycalm-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
21F:					
Klacking-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
22B:					
Montcalm-----	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
23:					
Ausable------	Severe: flooding, ponding, poor filter.	Severe: excess humus, flooding, seepage.	Severe: flooding, ponding, seepage.	Severe: flooding, ponding, seepage.	Poor: ponding, seepage, too sandy.
Bowstring----	Severe: flooding, percs slowly, wetness.	Severe: excess humus, flooding, seepage.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: excess humus, wetness.
24A:					
Kinross------	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Au Gres------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
26B:					
Cublake------	Severe: percs slowly, poor filter, wetness.	Severe: seepage, wetness.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
28B:					
East Lake----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
32B:					
Kellogg------	Severe: percs slowly, poor filter, wetness.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: hard to pack, too clayey.
35:					
Kinross------	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
47D:					
Graycalm-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
48B:					
Rubicon------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Graycalm-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
48D:					
Rubicon------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Graycalm-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
48E:					
Rubicon------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Graycalm-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
49B, 49B3:					
Kalkaska-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
49C:					
Kalkaska-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
49D, 49E:					
Kalkaska-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
50B:					
Au Gres------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Kinross------	Severe: ponding, poor filter.	Severe: ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Croswell-----	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
51:					
Tawas--------	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Leafriver----	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
53B:					
Negwegon-----	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: hard to pack, too clayey, wetness.
53C:					
Negwegon-----	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: hard to pack, too clayey, wetness.
54A:					
Algonquin----	Severe: percs slowly, wetness.	Slight----------	Severe: too clayey, wetness.	Severe: wetness.	Poor: hard to pack, too clayey, wetness.
58A:					
Wakeley------	Severe: percs slowly, ponding, poor filter.	Severe: ponding, seepage.	Severe: ponding, too clayey.	Severe: ponding, seepage.	Poor: hard to pack, ponding, too clayey.
Allendale----	Severe: percs slowly, poor filter, wetness.	Severe: seepage.	Severe: too clayey, wetness.	Severe: seepage, wetness.	Poor: hard to pack, too clayey, wetness.
75B:					
Rubicon------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
75D:					
Rubicon------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
75E:					
Rubicon------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
78.					
Pits, borrow					

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
81B:					
Grayling-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
81D:					
Grayling-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
81E, 81F:					
Grayling-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
83B:					
Udipsamments-	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
83F:					
Udipsamments-	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
86:					
Histosols----	Severe: ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding.	Poor: excess humus, ponding.
Aquents------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
87:					
Ausable------	Severe: flooding, ponding, poor filter.	Severe: excess humus, flooding, seepage.	Severe: flooding, ponding, seepage.	Severe: flooding, ponding, seepage.	Poor: ponding, seepage, too sandy.
99:					
Roscommon----	Severe: ponding, poor filter.	Severe: ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
131E:					
Rubicon------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Menominee----	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
147B:					
Lindquist----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
147C, 147D:					
Lindquist----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
147E:					
Lindquist----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
159A:					
Finch--------	Severe: cemented pan, poor filter, wetness.	Severe: cemented pan, seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: cemented pan, seepage, wetness.	Poor: cemented pan, seepage, too sandy.
174A:					
Au Gres------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Roscommon----	Severe: ponding, poor filter.	Severe: ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
197A:					
Gladwin------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, small stones, too sandy.
338B:					
Islandlake---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
338C:					
Islandlake---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
338D, 338E:					
Islandlake---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
360:					
Wakeley------	Severe: percs slowly, ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, too clayey.	Severe: ponding, seepage.	Poor: hard to pack, ponding, too clayey.
366B:					
Islandlake---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
366B:					
Blue Lake----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
366C, 366D:					
Islandlake---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Blue Lake----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
366E:					
Islandlake---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Blue Lake----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
371:					
Springport---	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: hard to pack, ponding, too clayey.
380. Access denied					
402B:					
Islandlake---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
402C:					
Islandlake---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy.
406A:					
Winterfield--	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
412A:					
Ingalls------	Severe: percs slowly, poor filter, wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
Burleigh-----	Severe: percs slowly, ponding, poor filter.	Severe: ponding, seepage.	Severe: ponding, too sandy.	Severe: ponding, seepage.	Poor: ponding.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
454B:					
Springlake---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
454C, 454D:					
Springlake---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
454E:					
Springlake---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
457B:					
Islandlake---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Southwells---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
457C:					
Islandlake---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy.
Southwells---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
457D:					
Islandlake---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Southwells---	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
457E:					
Islandlake---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Southwells---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: slope, too sandy.
458D:					
Islandlake---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
458D:					
Menominee----	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
459B, 459D:					
Rubicon------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
459E:					
Rubicon------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
460B:					
Rubicon------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Mancelona----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
460C:					
Rubicon------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Mancelona----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
460D:					
Rubicon------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Mancelona----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
460E, 460F:					
Rubicon------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Mancelona----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
461A:					
Allendale----	Severe: percs slowly, poor filter, wetness.	Severe: seepage.	Severe: too clayey, wetness.	Severe: seepage, wetness.	Poor: hard to pack, too clayey, wetness.
Springport---	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: hard to pack, ponding, too clayey.
462A:					
Allendale----	Severe: percs slowly, poor filter, wetness.	Severe: seepage.	Severe: too clayey, wetness.	Severe: seepage, wetness.	Poor: hard to pack, too clayey, wetness.
Algonquin----	Severe: percs slowly, wetness.	Slight----------	Severe: too clayey, wetness.	Severe: wetness.	Poor: hard to pack, too clayey, wetness.
466B:					
Halfaday-----	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
467B:					
Morganlake---	Severe: percs slowly, poor filter, wetness.	Severe: seepage, wetness.	Severe: too acid.	Severe: seepage.	Fair: too clayey, wetness.
Woodman------	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: hard to pack, too clayey, wetness.
Blue Lake----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
467C:					
Morganlake---	Severe: percs slowly, poor filter, wetness.	Severe: seepage, slope, wetness.	Severe: too acid.	Severe: seepage.	Fair: slope, too clayey, wetness.
Woodman------	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: hard to pack, too clayey, wetness.
Blue Lake----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
468F:					
Southwells---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: slope, too sandy.
Mancelona----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
Dighton------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: hard to pack, too clayey.
469B:					
Hodenpyl-----	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Montcalm-----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
471B:					
Mancelona----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
Blue Lake----	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
472B:					
Morganlake---	Severe: percs slowly, poor filter, wetness.	Severe: seepage, wetness.	Severe: too acid.	Severe: seepage.	Fair: too clayey, wetness.
488A:					
Allendale----	Severe: percs slowly, poor filter, wetness.	Severe: seepage.	Severe: too clayey, wetness.	Severe: seepage, wetness.	Poor: hard to pack, too clayey, wetness.
494:					
Gauld--------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
W.					
Water					

Table 15.—Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
13:				
Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Lupton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
14:				
Dawson	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Loxley	Poor: low strength, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, too acid, wetness.
15A:				
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
16B:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
16E:				
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
17A:				
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
18A:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
19:				
Leafriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
20B, 20D:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
20F:				
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
Grayling	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
21B, 21D:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
Klacking	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
21F:				
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
Klacking	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
22B:				
Montcalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
23:				
Ausable	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, too sandy, wetness.
Bowstring	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
24A:				
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
26B:				
Cublake	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
28B:				
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
32B:				
Kellogg	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
35:				
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
47D:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
48B, 48D:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
48E:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
49B, 49B3, 49C:				
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
49D:				
Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
49E:				
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
50B:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
50B:				
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
51:				
Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Leafriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
53B, 53C:				
Negwegon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
54A:				
Algonquin	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
58A:				
Wakeley	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Allendale	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
75B, 75D:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
75E:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
78. Pits, borrow				
81B, 81D:				
Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
81E, 81F:				
Grayling	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
83B:				
Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.
83F:				
Udipsamments	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
86:				
Histosols	Poor: low strength, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Aquents	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
87:				
Ausable	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, too sandy, wetness.
99:				
Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
131E:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Menominee	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope, small stones, too sandy.
147B, 147C, 147D:				
Lindquist	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
147E:				
Lindquist	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
159A:				
Finch	Poor: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim, cemented pan, too sandy.
174A:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
174A:				
Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
197A:				
Gladwin	Poor: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim, small stones.
338B, 338C:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
338D:				
Islandlake	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
338E:				
Islandlake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
360:				
Wakeley	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
366B, 366C, 366D:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
366E:				
Islandlake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
371:				
Springport	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
380.				
Access denied				
402B, 402C:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
406A:				
Winterfield	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
412A:				
Ingalls	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Burleigh	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
454B, 454C, 454D:				
Springlake	Good	Probable	Improbable: too sandy.	Poor: area reclaim, small stones, too sandy.
454E:				
Springlake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
457B:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Southwells	Good	Probable	Improbable: too sandy.	Poor: too sandy.
457C:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Southwells	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy.
457D:				
Islandlake	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy.
Southwells	Good	Probable	Improbable: too sandy.	Poor: too sandy.
457E:				
Islandlake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Southwells	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
458D:				
Islandlake	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Menominee	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
459B, 459D:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
459E:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
460B, 460C:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
460D:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Mancelona	Fair: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
460E:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Mancelona	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
460F:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Mancelona	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
461A:				
Allendale	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Springport	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
462A:				
Allendale	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Algonquin	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
466B:				
Halfaday	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
467B, 467C:				
Morganlake	Fair: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too acid, too sandy.
Woodman	Poor: low strength, shrink-swell.	Probable	Improbable: too sandy.	Poor: too clayey.
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
468F:				
Southwells	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Mancelona	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
Dighton	Poor: low strength, shrink-swell, slope.	Probable	Improbable: too sandy.	Poor: too clayey.
469B:				
Hodenpyl	Good	Probable	Improbable: too sandy.	Good.
Montcalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
471B:				
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.

Table 15.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
472B:				
Morganlake---------	Fair: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too acid, too sandy.
488A:				
Allendale----------	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
494:				
Gauld--------------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
W.				
Water				

Table 16.—Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
13:							
Tawas	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave, slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Lupton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing.	Limitation: wetness.
14:							
Dawson	Severe: seepage.	Severe: excess humus, ponding.	Severe: cutbanks cave, slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, rooting depth.	Limitation: ponding.	Limitation: rooting depth, wetness.
Loxley	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing, too acid.	Limitation: ponding, soil blowing.	Limitation: wetness.
15A:							
Croswell	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
Au Gres	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
16B:							
Graycalm----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
16E:							
Graycalm----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
17A:							
Croswell----------	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
18A:							
Au Gres-----------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
19:							
Leafriver---------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
20B:							
Graycalm----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Grayling----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
20D, 20F:							
Graycalm-----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Grayling-----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
21B:							
Graycalm-----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Klacking-----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
21D, 21F:							
Graycalm-----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Klacking-----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
22B:							
Montcalm-----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
23:							
Ausable	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, flooding, ponding.	Limitation: flooding, ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Bowstring	Severe: seepage.	Severe: excess humus, wetness.	Severe: cutbanks cave, slow refill.	Limitation: flooding, frost action, subsides.	Limitation: flooding, wetness.	Limitation: wetness.	Limitation: wetness.
24A:							
Kinross	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Au Gres	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
26B:							
Cublake	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: cutbanks cave, slope.	Limitation: droughty, slope, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty.
28B:							
East Lake	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
32B:							
Kellogg	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: droughty, slope, wetness.	Limitation: percs slowly, soil blowing, wetness.	Limitation: droughty, percs slowly.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
35:							
Kinross	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
47D:							
Graycalm	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
48B:							
Rubicon	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Graycalm	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
48D, 48E:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Graycalm	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
49B, 49B3:							
Kalkaska	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
49C, 49D, 49E:							
Kalkaska	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
50B:							
Au Gres	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
Kinross	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
Croswell	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, slope.	Limitation: droughty, slope, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
51:							
Tawas	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave, slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Leafriver	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
53B:							
Negwegon	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: percs slowly, slope, wetness.	Limitation: erodes easily, wetness.	Limitation: erodes easily, wetness.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
53C:							
Negwegon	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: percs slowly, slope, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: erodes easily, slope, wetness.
54A:							
Algonquin	Slight	Severe: wetness.	Severe: no water.	Limitation: frost action, percs slowly.	Limitation: percs slowly, wetness.	Limitation: erodes easily, percs slowly, wetness.	Limitation: erodes easily, percs slowly, wetness.
58A:							
Wakeley	Severe: seepage.	Severe: ponding.	Severe: no water.	Limitation: percs slowly, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: percs slowly, ponding, soil blowing.	Limitation: droughty, percs slowly, wetness.
Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly.	Limitation: droughty, wetness.	Limitation: percs slowly, soil blowing, wetness.	Limitation: droughty, percs slowly, wetness.
75B:							
Rubicon	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
75D, 75E:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
78.							
Pits, borrow							

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
81B:							
Grayling	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
81D, 81E, 81F:							
Grayling	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
83B:							
Udipsamments	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake.	Limitation: soil blowing, too sandy.	Limitation: droughty.
83F:							
Udipsamments	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
86:							
Histosols	Slight	Severe: excess humus, ponding.	Slight	Limitation: frost action, ponding.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing.	Limitation: wetness.
Aquents	Slight	Severe: ponding.	Slight	Limitation: frost action, ponding.	Limitation: ponding.	Limitation: ponding.	Limitation: wetness.
87:							
Ausable	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, flooding, ponding.	Limitation: flooding, ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
99:							
Roscommon----------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
131E:							
Rubicon------------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Menominee----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
147B:							
Lindquist----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
147C, 147D, 147E:							
Lindquist----------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
159A:							
Finch--------------	Severe: cemented pan, seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cemented pan, cutbanks cave.	Limitation: droughty, wetness.	Limitation: cemented pan, too sandy, wetness.	Limitation: cemented pan, droughty, wetness.
174A:							
Au Gres------------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
174A:							
Roscommon----------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
197A:							
Gladwin------------	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
338B:							
Islandlake---------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
338C, 338D, 338E:							
Islandlake---------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
360:							
Wakeley------------	Severe: seepage.	Severe: ponding.	Severe: no water.	Limitation: percs slowly, ponding.	Limitation: droughty, ponding.	Limitation: percs slowly, ponding, soil blowing.	Limitation: droughty, percs slowly, wetness.
366B:							
Islandlake---------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Blue Lake----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
366C, 366D, 366E:							
Islandlake---------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Blue Lake----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
371:							
Springport---------	Slight--------	Severe: ponding.	Severe: no water.	Limitation: frost action, percs slowly, ponding.	Limitation: percs slowly, ponding.	Limitation: erodes easily, percs slowly, ponding.	Limitation: erodes easily, percs slowly, wetness.
380.							
Access denied							
402B:							
Islandlake---------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
402C:							
Islandlake---------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
406A:							
Winterfield--------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, fast intake, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
412A:							
Ingalls	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave, slow refill.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: erodes easily, soil blowing, wetness.	Limitation: droughty, erodes easily, wetness.
Burleigh	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave, slow refill.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: erodes easily, ponding, soil blowing.	Limitation: droughty, erodes easily, wetness.
454B:							
Springlake	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
454C, 454D, 454E:							
Springlake	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
457B:							
Islandlake	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Southwells	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
457C, 457D, 457E:							
Islandlake	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
457C, 457D, 457E:							
Southwells	Severe: seepage, slope.	Moderate: thin layer.	Severe: deep to water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
458D:							
Islandlake	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Menominee	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing.	Limitation: droughty, slope.
459B, 459D, 459E:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
460B:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Mancelona	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
460C, 460D, 460E, 460F:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Mancelona	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
461A:							
Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly.	Limitation: droughty, wetness.	Limitation: percs slowly, soil blowing, wetness.	Limitation: droughty, percs slowly, wetness.
Springport	Slight	Severe: ponding.	Severe: slow refill.	Limitation: frost action, percs slowly, ponding.	Limitation: percs slowly, ponding.	Limitation: percs slowly, ponding.	Limitation: percs slowly, wetness.
462A:							
Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly.	Limitation: droughty, wetness.	Limitation: percs slowly, soil blowing, wetness.	Limitation: droughty, percs slowly, wetness.
Algonquin	Slight	Severe: wetness.	Severe: slow refill.	Limitation: frost action, percs slowly.	Limitation: percs slowly, wetness.	Limitation: erodes easily, percs slowly, wetness.	Limitation: erodes easily, percs slowly, wetness.
466B:							
Halfaday	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
467B:							
Morganlake	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, wetness.	Limitation: droughty, erodes easily.
Woodman	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: percs slowly, slope, wetness.	Limitation: erodes easily, wetness.	Limitation: erodes easily, wetness.
Blue Lake	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
467C:							
Morganlake	Severe: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: droughty, erodes easily, slope.
Woodman	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: percs slowly, slope, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: erodes easily, slope, wetness.
Blue Lake	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
468F:							
Southwells	Severe: seepage, slope.	Moderate: thin layer.	Severe: deep to water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
468F:							
Mancelona----------	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Dighton------------	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: percs slowly, slope.	Limitation: erodes easily, slope.	Limitation: erodes easily, slope.
469B:							
Hodenpyl-----------	Severe: seepage.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: slope, soil blowing.	Limitation: soil blowing.	Favorable.
Montcalm-----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
471B:							
Mancelona----------	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Blue Lake----------	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
472B:							
Morganlake---------	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, wetness.	Limitation: droughty, erodes easily.

Table 16.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
488A:							
Allendale----------	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly.	Limitation: droughty, wetness.	Limitation: percs slowly, soil blowing, wetness.	Limitation: droughty, percs slowly, wetness.
494:							
Gauld--------------	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Limitation: frost action, ponding.	Limitation: ponding.	Limitation: erodes easily, ponding, soil blowing.	Limitation: erodes easily, wetness.
W.							
Water							

Table 17.—Engineering Index Properties

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
13:												
Tawas-----------	0-7	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	7-21	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	21-80	Sand, loamy sand-	SP, SM, SP-SM	A-2-4, A-3	0	0	90-100	85-100	40-75	0-30	0-14	NP
Lupton----------	0-10	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	10-80	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
14:												
Dawson----------	0-4	Peat-------------	PT	A-8	0	0	---	---	---	---	---	---
	4-20	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	20-22	Silt loam, loam, loamy sand.	ML, CL-ML, SM, SP-SM	A-1-b, A-4, A-2-4	0	0	100	100	40-100	5-90	0-20	NP-5
	22-80	Sand-------------	SM, SP-SM	A-3, A-2-4	0	0	90-100	85-100	40-75	5-15	0-14	NP-10
Loxley----------	0-12	Peat-------------	PT	A-8	0	0	---	---	---	---	---	---
	12-80	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
15A:												
Croswell--------	0-8	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	0	85-100	80-100	40-70	5-15	0-14	NP
	8-23	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	23-32	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-75	5-15	0-14	NP
	32-80	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
Au Gres---------	0-9	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
	9-24	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	90-100	85-100	40-70	0-15	0-14	NP
	24-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
16B, 16E:												
Graycalm--------	0-3	Sand-------------	SM, SP-SM, SP	A-1-b, A-2, A-3	0	0-7	85-100	80-100	40-70	0-15	0-14	NP
	3-31	Sand-------------	SP, SM, SP-SM	A-1, A-3, A-2	0	0-7	85-100	80-100	35-70	1-15	0-14	NP
	31-80	Sand, loamy sand-	SM, SP-SM	A-1, A-2, A-3	0	0-7	85-100	80-100	30-75	5-30	0-14	NP
17A:												
Croswell--------	0-8	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	8-23	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	23-32	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-75	5-15	0-14	NP
	32-80	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
18A:												
Au Gres---------	0-9	Sand-------------	SP, SM, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
	9-24	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	90-100	85-100	40-70	0-15	0-14	NP
	24-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
19:												
Leafriver-------	0-14	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	14-80	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	5-15	0-14	NP
20B, 20D, 20F:												
Graycalm--------	0-3	Sand-------------	SM, SP, SP-SM	A-1-b, A-2, A-3	0	0-7	85-100	80-100	40-70	0-15	0-14	NP
	3-31	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-7	85-100	80-100	35-70	1-15	0-14	NP
	31-80	Sand, loamy sand-	SM, SP-SM	A-1, A-3, A-2	0	0-7	85-100	80-100	30-75	5-30	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
20B, 20D, 20F:												
Grayling--------	0-3	Sand-------------	SM, SP, SP-SM	A-2, A-1, A-3	0	0	95-100	90-100	45-70	0-15	0-14	NP
	3-30	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	0-15	0-14	NP
	30-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	45-70	0-15	0-14	NP
21B, 21D, 21F:												
Graycalm--------	0-3	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2	0	0-7	85-100	80-100	40-70	0-15	0-14	NP
	3-31	Sand-------------	SM, SP, SP-SM	A-2, A-1, A-3	0	0-7	85-100	80-100	35-70	1-15	0-14	NP
	31-80	Sand, loamy sand-	SM, SP-SM	A-1, A-2, A-3	0	0-7	85-100	80-100	30-75	5-30	0-14	NP
Klacking--------	0-2	Loamy sand-------	SM, SP-SM	A-1, A-2	0	0-7	90-100	80-100	35-75	10-30	0-14	NP
	2-21	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-7	90-100	80-100	35-75	0-30	0-14	NP
	21-80	Sand, loamy sand, sandy loam.	SC-SM, SP-SM, SM, SP	A-2, A-1, A-3, A-4	0	0-7	90-100	80-100	45-75	0-40	0-25	NP-7
22B:												
Montcalm--------	0-10	Loamy sand-------	SM, SP-SM	A-1, A-2	0	0-2	90-100	85-98	35-75	10-30	0-14	NP
	10-23	Loamy sand, sand-	SP-SM, SM, SP	A-2, A-1, A-3	0	0-2	90-100	85-98	35-75	0-30	0-14	NP
	23-46	Loamy sand, sandy loam.	SC-SM, SM, SC, SP-SM	A-2, A-3, A-1, A-4	0	0-2	90-100	85-98	40-90	5-50	15-25	NP-8
	46-80	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-2	90-100	85-98	35-75	0-15	0-14	NP
23:												
Ausable---------	0-11	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	11-38	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0-7	90-100	80-100	35-75	0-15	0-14	NP
	38-80	Sand-------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0-7	90-100	80-100	35-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
23:												
Bowstring-------	0-37	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	37-47	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0	0	100	100	45-70	0-15	0-14	NP
	47-80	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
24A:												
Kinross---------	0-2	Muck-------------	PT	A-8	0	0	---	---	---	---	0-0	NP
	2-20	Sand-------------	SM, SP, SP-SM	A-2, A-3, A-1	0	0	95-100	92-100	45-70	0-15	0-14	NP
	20-80	Sand-------------	SM, SP-SM, SP	A-2, A-1, A-3	0	0	95-100	92-100	45-70	0-15	0-14	NP
Au Gres---------	0-9	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
	9-24	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
	24-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
26B:												
Cublake---------	0-8	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	0	90-100	80-100	40-70	5-15	0-14	NP
	8-31	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	80-100	40-70	5-15	0-14	NP
	31-56	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	80-100	40-70	5-15	0-14	NP
	56-80	Stratified loamy sand to silty clay loam.	CL-ML, CL, SC, SC-SM	A-2-6, A-4, A-2-4, A-6	0	0	95-100	90-100	45-95	10-95	0-41	4-20
28B:												
East Lake-------	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	0-15	90-100	80-100	40-70	5-15	0-14	NP
	3-28	Sand, gravelly loamy sand.	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-15	90-99	70-99	35-75	0-30	0-14	NP
	28-80	Stratified gravelly sand to sand.	GP, SP-SM, GP-GM, SP	A-1, A-2-4, A-3	0	0-15	55-90	50-85	45-70	0-10	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
32B:												
Kellogg	0-9	Sand	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	95-100	90-100	45-75	5-15	0-14	NP
	9-32	Sand, loamy sand	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	95-100	90-100	45-75	5-30	0-14	NP
	32-40	Sand, loamy sand, silty clay loam, silty clay.	CL-ML, CL, SC, SC-SM	A-2-4, A-7, A-4, A-6	0	0	90-100	85-100	40-100	15-95	20-50	4-25
	40-60	Silty clay, silty clay loam.	CH, CL	A-7	0	0	90-100	85-100	80-100	70-95	40-65	20-40
	60-80	Silty clay, silty clay loam.	CH, CL	A-7	0	0	90-100	85-100	80-100	70-95	40-65	20-40
35:												
Kinross	0-2	Muck	PT	A-8	0	0	---	---	---	---	0-0	NP
	2-20	Sand	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	92-100	45-70	0-15	0-14	NP
	20-80	Sand	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	92-100	45-70	0-15	0-14	NP
47D:												
Graycalm	0-3	Sand	SM, SP, SP-SM	A-1-b, A-2, A-3	0	0-7	85-100	80-100	40-70	0-15	0-14	NP
	3-31	Sand	SM, SP, SP-SM	A-1, A-3, A-2	0	0-7	85-100	80-100	35-70	1-15	0-14	NP
	31-80	Sand, loamy sand	SM, SP-SM	A-1, A-2, A-3	0	0-7	85-100	80-100	30-75	5-30	0-14	NP
48B, 48D, 48E:												
Rubicon	0-6	Sand	SM, SP, SP-SM	A-2, A-1, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
	6-34	Sand	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
	34-80	Sand	SM, SP, SP-SM	A-2, A-1, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
48B, 48D, 48E:												
Graycalm--------	0-3	Sand-------------	SM, SP-SM, SP	A-1-b, A-2, A-3	0	0-7	85-100	80-100	40-70	0-15	0-14	NP
	3-31	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-7	85-100	80-100	35-70	1-15	0-14	NP
	31-80	Sand, loamy sand-	SM, SP-SM	A-1, A-3, A-2	0	0-7	85-100	80-100	30-75	5-30	0-14	NP
49B:												
Kalkaska--------	0-4	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-75	5-15	0-14	NP
	4-6	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-75	5-30	0-14	NP
	6-50	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-75	5-15	0-14	NP
	50-80	Sand-------------	SM, SP, SP-SM	A-2-4, A-3, A-1-b	0	0-7	90-100	85-100	45-70	0-15	0-14	NP
49B3:												
Kalkaska--------	0-50	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-75	5-15	0-14	NP
	50-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-70	0-15	0-14	NP
49C, 49D, 49E:												
Kalkaska--------	0-4	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4,	0	0-7	90-100	85-100	45-75	5-15	0-14	NP
	4-6	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-75	5-30	0-14	NP
	6-50	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-75	5-15	0-14	NP
	50-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	45-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
50B:												
Au Gres---------	0-9	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
	9-24	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	90-100	85-100	40-70	0-15	0-14	NP
	24-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
Kinross---------	0-2	Muck-------------	PT	A-8	0	0	---	---	---	---	0-0	NP
	2-20	Sand-------------	SP-SM, SM, SP	A-2, A-1, A-3	0	0	95-100	92-100	45-70	0-15	0-14	NP
	20-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	92-100	45-70	0-15	0-14	NP
Croswell--------	0-8	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	0	85-100	80-100	40-70	5-15	0-14	NP
	8-23	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	0	85-100	80-100	40-70	5-15	0-14	NP
	23-32	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-75	5-15	0-14	NP
	32-80	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
51:												
Tawas-----------	0-7	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	7-21	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	21-80	Sand, loamy sand-	SP, SM, SP-SM	A-2-4, A-3	0	0	90-100	85-100	40-75	0-30	0-14	NP
Leafriver-------	0-14	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	14-80	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	0	90-100	85-100	40-70	5-15	0-14	NP
53B, 53C:												
Negwegon--------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	0-1	95-100	92-100	80-100	65-90	20-40	5-15
	6-25	Silty clay loam, silty clay.	CH, CL	A-7	0	0	95-100	92-100	85-100	75-95	40-65	20-40
	25-80	Stratified silt loam to silty clay.	CH, CL	A-7	0	0	95-100	92-100	80-100	65-95	40-65	20-40

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
54A:												
Algonquin-------	0-9	Silt loam--------	CL	A-4, A-6	0	0-2	95-100	95-100	80-100	70-90	25-40	7-15
	9-36	Silty clay, silty clay loam.	CH, CL	A-7	0	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	36-80	Silty clay, clay-	CH, CL	A-7	0	0-2	95-100	95-100	85-100	80-95	40-65	20-40
58A:												
Wakeley---------	0-7	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	7-22	Sand-------------	SM, SC-SM, SP, SP-SM	A-2-4, A-3	0	0-5	90-100	85-100	35-75	0-30	15-25	NP-7
	22-80	Clay, silty clay-	CH, CL	A-7	0	0	95-100	95-100	95-100	80-95	40-65	20-40
Allendale-------	0-10	Sand-------------	SM, SP-SM, SW-SM	A-2-4, A-3, A-1-b	0	0	95-100	90-100	45-80	5-35	0-14	NP
	10-22	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	90-100	45-80	5-30	0-14	NP
	22-80	Silty clay, clay-	CH, MH	A-7	0	0	100	95-100	90-100	80-95	50-70	20-40
75B, 75D, 75E:												
Rubicon---------	0-6	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
	6-34	Sand-------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
	34-80	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
78.												
Pits, borrow												
81B, 81D, 81E, 81F:												
Grayling-------	0-3	Sand-------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	0-15	0-14	NP
	3-30	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	0-15	0-14	NP
	30-80	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	90-100	45-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
83B, 83F:												
Udipsamments----	0-80	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	75-100	30-75	0-25	0-14	NP
86:												
Histosols-------	0-80	Muck-------------	PT	A-8	0	0	---	---	---	---	---	NP
Aquents---------	0-5	Muck-------------	PT	A-8	---	---	---	---	---	---	---	---
	5-8	Loamy fine sand--	SP-SM, SM	A-2	0	0	90-100	85-100	80-95	10-55	0-14	NP
	8-80	Sand-------------	SM, SP-SM, SP	A-2, A-1, A-3	0	0	90-100	85-100	40-70	0-15	0-14	NP
87:												
Ausable---------	0-11	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	11-37	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0-7	90-100	80-100	35-75	0-15	0-14	NP
	37-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0-7	90-100	80-100	35-70	0-15	0-14	NP
99:												
Roscommon-------	0-9	Mucky sand-------	SM, SP-SM	A-2, A-1, A-3	0	0	90-100	85-100	40-70	5-15	0-20	NP
	9-80	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	90-100	85-100	40-70	0-15	0-20	NP
131E:												
Rubicon---------	0-6	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
	6-34	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP
	34-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	85-100	80-100	35-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
131E:												
Menominee-------	0-7	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	0-7	95-100	92-100	45-75	5-15	0-14	NP
	7-33	Sand, loamy sand-	SC-SM, SM, SP-SM	A-2, A-1, A-3	0	0-7	95-100	92-100	45-75	5-30	0-14	NP
	33-58	Loamy sand, sandy loam, clay loam, sand.	CL, SM, CL-ML, SC-SM	A-2, A-4, A-6	0	0-7	90-100	90-100	45-100	5-85	0-40	NP-20
	58-80	Silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	0-7	90-100	90-100	80-100	65-95	25-40	5-20
147B, 147C, 147D, 147E:												
Lindquist------	0-5	Sand-------------	SM, SP, SP-SM	A-2-4, A-3, A-1-b	0	0-7	85-100	80-100	35-70	0-15	0-14	NP
	5-34	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0-7	85-100	80-100	35-70	0-15	0-14	NP
	34-39	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0-7	85-100	80-100	35-70	0-15	0-14	NP
	39-77	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	85-100	80-100	35-75	5-25	0-14	NP
	77-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0-7	85-100	80-100	35-70	0-15	0-14	NP
159A:												
Finch-----------	0-2	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	95-100	95-100	45-75	5-15	---	NP
	2-11	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	95-100	95-100	45-75	5-15	---	NP
	11-27	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	95-100	95-100	45-75	5-15	---	NP
	27-80	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	95-100	95-100	45-75	5-15	---	NP
174A:												
Au Gres---------	0-9	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP
	9-24	Sand-------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0	90-100	85-100	40-70	0-15	0-14	NP
	24-80	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
174A:												
Roscommon-------	0-9	Mucky sand-------	SM, SP-SM	A-1, A-3, A-2	0	0	90-100	85-100	40-70	5-15	0-20	NP
	9-80	Sand-------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0	90-100	85-100	40-70	0-15	0-20	NP
197A:												
Gladwin---------	0-13	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-7	95-100	75-95	45-70	10-30	15-20	NP-4
	13-17	Sand, loamy sand-	SC-SM, SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	95-100	75-95	35-70	5-30	15-25	NP-5
	17-32	Sandy loam, gravelly sandy loam.	SC, SM, SC-SM	A-1-b, A-2-4	0	0-7	85-100	60-95	35-70	15-35	15-30	NP-9
	32-80	Stratified sand to very gravelly loamy sand.	GP-GM, GP, SP, SP-SM	A-3, A-2-4, A-1	0	0-15	40-85	40-80	20-65	0-10	0-14	NP
338B, 338C, 338D, 338E:												
Islandlake-----	0-5	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0-5	85-100	80-100	35-75	0-15	0-14	NP
	5-6	Sand, loamy sand-	SM, SP-SM, SP	A-1, A-2, A-3	0	0-5	85-100	80-100	35-75	0-30	0-14	NP
	6-27	Sand-------------	SP, SP-SM	A-1, A-3, A-2	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	27-52	Sand-------------	SP, SP-SM	A-1, A-2, A-3	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	52-80	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-5	85-100	80-100	35-70	0-30	0-14	NP
360:												
Wakeley---------	0-7	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	7-22	Sand-------------	SM, SC-SM, SP, SP-SM	A-2-4, A-3	0	0-5	90-100	85-100	35-75	0-30	15-25	NP-7
	22-80	Clay, silty clay-	CH, CL	A-7	0	0	95-100	95-100	95-100	80-95	40-65	20-40

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
366B, 366C, 366D, 366E:												
Islandlake-----	0-5	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0-5	85-100	80-100	35-75	0-15	0-14	NP
	5-6	Sand, loamy sand-	SP-SM, SP, SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-75	0-30	0-14	NP
	6-27	Sand-------------	SP, SP-SM	A-2, A-1, A-3	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	27-52	Sand-------------	SP, SP-SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	52-80	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-5	85-100	80-100	35-70	0-30	0-14	NP
Blue Lake------	0-6	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-7	90-100	85-100	40-75	10-30	0-14	NP
	6-27	Loamy sand, sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	40-75	5-30	0-14	NP
	27-80	Stratified sand to sandy loam.	SM, SP-SM	A-1, A-2-4, A-4, A-3	0	0-7	90-100	85-100	40-75	5-40	0-25	NP-7
371:												
Springport------	0-8	Silt loam--------	CL	A-4, A-6	0	0-1	98-100	98-100	80-100	70-90	25-40	7-15
	8-13	Silty clay, silty clay loam.	CH, CL	A-7	0	0-1	98-100	98-100	85-100	80-95	40-65	20-40
	13-80	Silty clay, silty clay loam.	CH, CL	A-7	0	0-1	98-100	98-100	85-100	80-95	40-65	20-40
380.												
Access denied												
402B, 402C:												
Islandlake------	0-9	Loamy sand-------	SM, SP-SM	A-2, A-1	0	0-5	85-100	80-100	40-75	10-30	0-14	NP
	9-18	Loamy sand-------	SP-SM	A-2, A-1	0	0-5	85-100	80-100	40-75	10-30	0-14	NP
	18-45	Sand-------------	SP-SM	A-2, A-3, A-1	0	0-5	85-100	80-100	40-70	5-15	0-14	NP
	45-80	Sand, loamy sand-	SM, SP-SM	A-2, A-1, A-3	0	0-5	85-100	80-100	40-70	5-25	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
406A:												
Winterfield-----	0-7	Loamy sand-------	SC-SM, SM	A-2-4	0	0	80-100	80-100	50-90	5-30	15-25	NP-7
	7-21	Sand, loamy sand, gravelly loamy sand, gravelly sand.	SC-SM, SM	A-2-4	0	0	80-100	70-100	35-70	0-30	0-14	NP
	21-80	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	0	80-100	80-100	45-70	0-15	0-14	NP
412A:												
Ingalls---------	0-8	Loamy sand-------	SM, SP-SM	A-1, A-2	0	0-10	95-100	92-100	45-75	10-30	0-14	NP
	8-26	Loamy sand, sand-	SM, SP-SM	A-2, A-1, A-3	0	0-10	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Stratified silt loam to loamy fine sand.	CL, SC-SM, CL-ML, SC	A-4, A-6	0	0	95-100	92-100	65-100	45-95	20-35	4-15
Burleigh--------	0-9	Loamy sand-------	SM, SP-SM	A-2-4	0	0	97-100	92-100	45-75	10-30	0-14	NP
	9-21	Sand, loamy sand-	SM, SP-SM	A-2-4, A-3	0	0	97-100	92-100	45-75	5-30	0-14	NP
	21-80	Stratified fine sand to silty clay loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	97-100	92-100	75-100	35-90	20-40	NP-15
454B, 454C, 454D, 454E:												
Springlake-----	0-5	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-98	85-98	45-75	5-15	0-14	NP
	5-7	Loamy sand, sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-98	85-98	40-75	5-30	0-14	NP
	7-37	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0-7	90-98	85-98	45-75	5-15	0-14	NP
	37-80	Sand, gravelly sand, gravelly loamy sand.	SP, SP-SM	A-1-b, A-3, A-2-4	0	0-7	70-95	60-92	40-60	0-25	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
457B:												
Islandlake------	0-5	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-5	85-100	80-100	35-75	0-15	0-14	NP
	5-6	Sand, loamy sand-	SP, SP-SM, SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-75	0-30	0-14	NP
	6-27	Sand-------------	SP, SP-SM	A-2, A-1, A-3	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	27-52	Sand-------------	SP, SP-SM	A-3, A-1, A-2	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	52-80	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-5	85-100	80-100	35-70	0-30	0-14	NP
Southwells------	0-1	Sand-------------	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	1-3	Loamy sand, sand-	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	3-25	Loamy sand, sand-	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	25-65	Loamy sand, sand, sandy loam.	SP-SC, SC	A-6, A-4, A-2-4	0	0-5	85-100	80-100	40-75	5-40	0-25	9-12
	65-72	Sandy loam-------	SP-SC, SC	A-2-6, A-2-4	0	0-5	85-100	80-100	50-75	5-30	0-25	9-12
	72-80	Loamy sand, sand-	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
457C, 457D, 457E:												
Islandlake------	0-5	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0-5	85-100	80-100	35-75	0-15	0-14	NP
	5-6	Sand, loamy sand-	SP, SP-SM, SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-75	0-30	0-14	NP
	6-27	Sand-------------	SP, SP-SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	27-52	Sand-------------	SP, SP-SM	A-3, A-1, A-2	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	52-80	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-5	85-100	80-100	35-70	0-30	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
457C, 457D, 457E:												
Southwells------	0-1	Sand-------------	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	1-3	Loamy sand, sand-	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	3-25	Loamy sand, sand-	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	25-66	Loamy sand, sand, sandy loam.	SP-SC, SC	A-6, A-4, A-2-4	0	0-5	85-100	80-100	40-75	5-40	0-25	9-12
	66-73	Sandy loam-------	SP-SC, SC	A-2-6, A-2-4	0	0-5	85-100	80-100	50-75	5-30	0-25	9-12
	73-80	Loamy sand, sand-	SM, SP-SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
458D:												
Islandlake------	0-5	Sand-------------	SM, SP, SP-SM	A-2, A-1, A-3	0	0-5	85-100	80-100	35-75	0-15	0-14	NP
	5-6	Sand, loamy sand-	SP, SP-SM, SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-75	0-30	0-14	NP
	6-27	Sand-------------	SP, SP-SM	A-2, A-3, A-1	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	27-52	Sand-------------	SP, SP-SM	A-3, A-1, A-2	0	0-5	85-100	80-100	35-70	0-15	0-14	NP
	52-80	Sand, loamy sand-	SM, SP-SM, SP	A-1, A-3, A-2	0	0-5	85-100	80-100	35-70	0-30	0-14	NP
Menominee-------	0-7	Sand-------------	SM, SP-SM	A-1, A-3, A-2	0	0-7	95-100	92-100	45-75	5-15	0-14	NP
	7-33	Sand, loamy sand-	SM, SC-SM, SP-SM	A-2, A-1, A-3	0	0-7	95-100	92-100	45-75	5-30	0-14	NP
	33-58	Loamy sand, sandy loam, clay loam, sand.	CL-ML, CL, SC-SM, SM	A-2, A-4, A-6	0	0-7	90-100	90-100	45-100	5-85	0-40	NP-20
	58-80	Silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	0-7	90-100	90-100	80-100	65-95	25-40	5-20

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
459B, 459D, 459E:												
Rubicon---------	0-6	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	6-38	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	38-67	Sand-------------	SP, SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	0-15	0-14	NP
	67-80	Loamy sand, sand-	SM, SP, SP-SM	A-2-4, A-3, A-1-b	0	0	85-100	80-100	35-75	0-30	0-14	NP
460B, 460C, 460D, 460E, 460F:												
Rubicon--------	0-6	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	6-38	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	5-15	0-14	NP
	38-67	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	85-100	80-100	40-70	0-15	0-14	NP
	67-80	Loamy sand, sand-	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	85-100	80-100	35-75	0-30	0-14	NP
Mancelona------	0-7	Sand-------------	SM, SP-SM	A-1-b, A-2, A-3	0	0-15	90-95	85-95	40-70	5-15	0-14	NP
	7-21	Loamy sand, sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-15	90-95	85-95	40-75	5-30	0-14	NP
	21-35	Gravelly loamy sand, sandy loam, gravelly sandy loam.	SC, SP-SC, SC-SM	A-2-4, A-4	0	0-15	85-95	70-95	40-75	10-40	0-25	9-12
	35-80	Very gravelly sand, gravelly sand, sand.	GW, SP, GP, SW	A-1, A-2, A-3	0	0-15	40-90	30-85	20-60	0-15	---	NP
461A:												
Allendale-------	0-10	Sand-------------	SM, SP-SM, SW-SM	A-2-4, A-3, A-1-b	0	0	95-100	90-100	45-80	5-35	0-14	NP
	10-22	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	90-100	45-80	5-30	0-14	NP
	22-80	Silty clay, clay-	CH, MH	A-7	0	0	100	95-100	90-100	80-95	50-70	20-40

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
461A:												
Springport------	0-8	Silt loam--------	CL	A-4, A-6	0	0-1	98-100	98-100	80-100	70-90	25-40	7-15
	8-13	Silty clay, silty clay loam.	CH, CL	A-7	0	0-1	98-100	98-100	85-100	80-95	40-65	20-40
	13-80	Silty clay, silty clay loam.	CH, CL	A-7	0	0-1	98-100	98-100	85-100	80-95	40-65	20-40
462A:												
Allendale-------	0-10	Sand-------------	SM, SP-SM, SW-SM	A-2-4, A-3, A-1-b	0	0	95-100	90-100	45-80	5-35	0-14	NP
	10-22	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	90-100	45-80	5-30	0-14	NP
	22-80	Silty clay, clay-	CH, MH	A-7	0	0	100	95-100	90-100	80-95	50-70	20-40
Algonquin-------	0-9	Silt loam--------	CL	A-4, A-6	0	0-2	95-100	95-100	80-100	70-90	25-40	7-15
	9-36	Silty clay, silty clay loam.	CH, CL	A-7	0	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	36-80	Silty clay, clay-	CH, CL	A-7	0	0-2	95-100	95-100	85-100	80-95	40-65	20-40
466B:												
Halfaday--------	0-4	Loamy sand-------	SM, SP-SM	A-1, A-2-4	0	0	95-100	85-100	40-75	10-30	0-14	NP
	4-35	Loamy sand, sand-	SM, SP-SM	A-1, A-2-4	0	0	95-100	85-100	40-75	5-30	0-14	NP
	35-80	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	0	100	85-100	40-70	5-15	0-14	NP
467B, 467C:												
Morganlake------	0-7	Loamy sand-------	SM, SP-SM	A-2-4	0	0	95-100	92-100	45-75	5-15	0-14	NP
	7-35	Loamy sand, sand, sandy loam.	SM, SP-SM	A-4, A-3, A-2-4, A-1	0	0	95-100	92-100	45-75	5-50	0-14	NP
	35-49	Fine sandy loam, clay loam.	CL-ML, CL	A-6, A-4	0	0	95-100	92-100	55-100	35-80	20-40	6-20
	49-66	Loam, sandy clay loam.	ML, CL	A-6, A-4	0	0	95-100	92-100	65-90	30-75	20-40	3-20
	66-80	Stratified sand to sandy loam.	SP-SM, SM	A-4, A-1, A-3, A-2-4	0	0	95-100	92-100	40-75	5-40	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
467B, 467C:												
Woodman---------	0-9	Sandy loam-------	SM, SC-SM	A-4	0	0-7	85-100	80-99	50-70	25-40	12-20	2-4
	9-20	Sandy clay loam, fine sandy loam, loam, sandy loam.	SM, ML, SC	A-4, A-2-6	0	0-7	85-100	80-99	50-95	25-75	12-35	2-15
	20-37	Clay loam, silty clay loam, sandy clay loam.	SC, CL	A-6, A-7, A-4	0	0-7	85-100	80-99	65-99	30-95	28-43	9-21
	37-56	Sandy clay loam, silt loam, sandy loam.	ML, SC, SM	A-2-4, A-4	0	0-7	85-100	80-99	50-99	25-90	12-40	2-18
	56-80	Loamy sand, sand, sandy loam.	SP-SM, SM	A-1, A-3, A-4, A-2-4	0	0-7	85-100	80-99	40-75	5-40	0-14	NP-4
Blue Lake-------	0-6	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-7	90-100	85-100	40-75	10-30	0-14	NP
	6-27	Loamy sand, sand-	SM, SP-SM	A-2-4, A-3, A-1-b	0	0-7	90-100	85-100	40-75	5-30	0-14	NP
	27-80	Stratified sand to sandy loam.	SM, SP-SM	A-2-4, A-1, A-3, A-4	0	0-7	90-100	85-100	40-75	5-40	0-25	NP-7
468F:												
Southwells------	0-1	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	1-3	Loamy sand, sand-	SP-SM, SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	3-25	Loamy sand, sand-	SM, SP-SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP
	25-66	Loamy sand, sand, sandy loam.	SP-SC, SC	A-6, A-2-4, A-4	0	0-5	85-100	80-100	40-75	5-40	0-25	9-12
	66-73	Sandy loam-------	SP-SC, SC	A-2-6, A-2-4	0	0-5	85-100	80-100	50-75	5-30	0-25	9-12
	73-80	Loamy sand, sand-	SM, SP-SM	A-2-4, A-3	0	0-5	85-100	80-100	40-75	5-30	0-0	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
468F:												
Mancelona-------	0-7	Sand-------------	SM, SP-SM	A-2, A-1-b, A-3	0	0-15	90-95	85-95	40-70	5-15	0-14	NP
	7-21	Loamy sand, sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-15	90-95	85-95	40-75	5-30	0-14	NP
	21-35	Gravelly loamy sand, sandy loam, gravelly sandy loam.	SC, SC-SM, SP-SC	A-2-4, A-4	0	0-15	85-95	70-95	40-75	10-40	0-25	9-12
	35-80	Very gravelly sand, gravelly sand, sand.	GP, GW, SW, SP	A-1, A-2, A-3	0	0-15	40-90	30-85	20-60	0-15	---	NP
Dighton---------	0-8	Sandy loam-------	SM, SC-SM	A-4	0	0-5	95-99	92-99	55-85	30-50	12-20	2-7
	8-26	Clay, clay loam, silty clay loam.	CH, CL	A-7	0	0-5	95-99	92-99	75-99	50-95	35-55	15-25
	26-37	Clay loam, silty clay, silty clay loam.	CH, CL	A-6, A-7	0	0-5	95-99	92-99	75-99	50-95	35-55	20-30
	37-80	Gravelly sand, sand.	SP-SM, SP, SM	A-3, A-1-b, A-2-4	0	0-5	75-97	60-95	35-70	0-25	0-14	NP
469B:												
Hodenpyl--------	0-14	Fine sandy loam--	SC-SM, SM	A-2-4, A-4	0	0	95-100	95-100	55-85	25-50	0-25	2-7
	14-34	Sandy loam, fine sandy loam, loam.	ML, SC, CL, SM	A-2, A-4	0	0	95-100	95-100	50-95	25-75	0-25	2-9
	34-80	Sandy loam, loamy sand, sand.	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	80-100	40-75	5-40	0-25	NP-7
Montcalm--------	0-10	Loamy sand-------	SM, SP-SM	A-1, A-2	0	0-2	90-100	85-98	35-75	10-30	0-14	NP
	10-23	Loamy sand, sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-2	90-100	85-98	35-75	0-30	0-14	NP
	23-46	Loamy sand, sandy loam.	SC-SM, SM, SC, SP-SM	A-1, A-2, A-4, A-3	0	0-2	90-100	85-98	40-90	5-50	15-25	NP-8
	46-80	Sand, loamy sand-	SM, SP, SP-SM	A-1, A-2, A-3	0	0-2	90-100	85-98	35-75	0-15	0-14	NP

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
471B:												
Mancelona-------	0-7	Sand-------------	SM, SP-SM	A-2, A-1-b, A-3	0	0-15	90-95	85-95	40-70	5-15	0-14	NP
	7-21	Loamy sand, sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-15	90-95	85-95	40-75	5-30	0-14	NP
	21-35	Gravelly loamy sand, sandy loam, gravelly sandy loam.	SC, SP-SC, SC-SM	A-2-4, A-4	0	0-15	85-95	70-95	40-75	10-40	0-25	9-12
	35-80	Very gravelly sand, gravelly sand, sand.	GW, SP, GP, SW	A-1, A-2, A-3	0	0-15	40-90	30-85	20-60	0-15	---	NP
Blue Lake-------	0-6	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-7	90-100	85-100	40-75	10-30	0-14	NP
	6-27	Loamy sand, sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-7	90-100	85-100	40-75	5-30	0-14	NP
	27-80	Stratified sand to sandy loam.	SM, SP-SM	A-2-4, A-1, A-3, A-4	0	0-7	90-100	85-100	40-75	5-40	0-25	NP-7
472B:												
Morganlake------	0-7	Loamy sand-------	SM, SP-SM	A-2-4	0	0	95-100	92-100	45-75	5-15	0-14	NP
	7-35	Loamy sand, sand, sandy loam.	SM, SP-SM	A-3, A-4, A-1, A-2-4	0	0	95-100	92-100	45-75	5-50	0-14	NP
	35-49	Fine sandy loam, clay loam.	CL, CL-ML	A-6, A-4	0	0	95-100	92-100	55-100	35-80	20-40	6-20
	49-66	Loam, sandy clay loam.	CL, ML	A-6, A-4	0	0	95-100	92-100	65-90	30-75	20-40	3-20
	66-80	Stratified sand to sandy loam.	SP-SM, SM	A-4, A-3, A-1, A-2-4	0	0	95-100	92-100	40-75	5-40	0-14	NP
488A:												
Allendale-------	0-10	Sand-------------	SM, SP-SM, SW-SM	A-2-4, A-3, A-1-b	0	0	95-100	90-100	45-80	5-35	0-14	NP
	10-22	Sand, loamy sand-	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	90-100	45-80	5-30	0-14	NP
	22-80	Silty clay, clay-	CH, MH	A-7	0	0	100	95-100	90-100	80-95	50-70	20-40

Table 17.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
494:												
Gauld-----------	0-9	Fine sandy loam--	SC-SM, SM	A-4	0	0	95-100	95-100	60-85	35-50	15-25	NP-6
	9-22	Fine sandy loam, sandy clay loam, silt loam, sandy loam.	ML, SC-SM, CL-ML, SM	A-4	0	0	95-100	95-100	55-90	25-55	15-25	2-10
	22-80	Stratified sand to sandy loam to silt loam to silt.	ML, SM	A-4, A-3, A-2-4	0	0	90-100	80-100	40-100	5-80	0-14	NP
W.												
Water												

Table 18.—Physical Properties of Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
13:												
Tawas-----------	0-7	---	0.30-0.55	0.20-6.00	0.35-0.45	---	40-60	---	---	2	2	134
	7-21	---	0.30-0.55	0.20-6.00	0.24-0.45	---	40-60	---	---			
	21-80	0-10	1.40-1.65	6.00-20.00	0.03-0.10	0.0-2.9	---	.15	.15			
Lupton----------	0-10	0-0	0.10-0.35	0.20-6.00	0.35-0.45	---	70-90	---	---	3	2	134
	10-80	0-0	0.10-0.35	0.20-6.00	0.35-0.45	---	70-90	---	---			
14:												
Dawson----------	0-4	0-0	0.15-0.30	6.00-20.00	0.55-0.65	---	65-85	---	---	2	5	56
	4-20	0-0	0.15-0.40	0.20-6.00	0.35-0.45	---	65-85	---	---			
	20-22	10-15	1.55-1.75	0.60-2.00	0.18-0.20	0.0-2.9	5.0-15	.24	.24			
	22-80	0-10	1.55-1.75	6.00-20.00	0.03-0.10	0.0-2.9	0.0-0.5	.10	.15			
Loxley----------	0-12	0-0	0.15-0.40	0.20-6.00	0.35-0.45	---	70-90	---	---	2	5	56
	12-80	0-0	0.10-0.35	0.20-6.00	0.35-0.45	---	70-90	---	---			
15A:												
Croswell--------	0-8	0-10	1.30-1.55	6.00-20.00	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	8-23	0-10	1.40-1.60	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	23-32	0-10	1.40-1.60	6.00-20.00	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	32-80	0-10	1.50-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
Au Gres---------	0-9	0-8	1.30-1.55	6.00-20.00	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-24	0-8	1.50-1.70	6.00-20.00	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	24-80	0-8	1.50-1.70	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
16B, 16E:												
Graycalm--------	0-3	0-10	1.30-1.55	6.00-20.00	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	3-31	0-10	1.25-1.60	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	31-80	0-15	1.50-1.65	6.00-20.00	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
17A:												
Croswell--------	0-8	0-10	1.30-1.55	6.00-20.00	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	8-23	0-10	1.40-1.60	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	23-32	0-10	1.40-1.60	6.00-20.00	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	32-80	0-10	1.50-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
18A:												
Au Gres---------	0-9	0-8	1.30-1.55	6.00-20.00	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-24	0-8	1.50-1.70	6.00-20.00	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	24-80	0-8	1.50-1.70	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
19:												
Leafriver-------	0-14	---	0.10-0.25	0.60-6.00	0.35-0.50	---	50-90	---	---	5	2	134
	14-80	0-10	1.50-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.5-5.0	.15	.15			
20B, 20D, 20F:												
Graycalm--------	0-3	0-10	1.30-1.55	6.00-20.00	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	3-31	0-10	1.25-1.60	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	31-80	0-15	1.50-1.65	6.00-20.00	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
Grayling--------	0-3	0-10	1.30-1.65	6.00-20.00	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	3-30	0-10	1.30-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	30-80	0-10	1.45-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
21B, 21D, 21F:												
Graycalm--------	0-3	0-10	1.30-1.55	6.00-20.00	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	3-31	0-10	1.25-1.60	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	31-80	0-15	1.50-1.65	6.00-20.00	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
Klacking--------	0-2	2-12	1.35-1.65	6.00-20.00	0.08-0.11	0.0-2.9	1.0-2.0	.15	.17	5	2	134
	2-21	0-15	1.35-1.65	6.00-20.00	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			
	21-80	2-18	1.55-1.70	2.00-6.00	0.05-0.11	0.0-2.9	0.0-0.5	.15	.17			
22B:												
Montcalm--------	0-10	2-10	1.35-1.65	6.00-20.00	0.09-0.12	0.0-2.9	0.5-3.0	.17	.17	5	2	134
	10-23	0-15	1.30-1.60	6.00-20.00	0.09-0.10	0.0-2.9	0.5-2.0	.15	.17			
	23-46	5-18	1.30-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.15	.17			
	46-80	2-10	1.55-1.70	6.00-20.00	0.04-0.10	0.0-2.9	0.0-0.5	.15	.17			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
23:												
Ausable---------	0-11	0-0	0.20-0.30	0.60-6.00	0.35-0.45	---	70-90	---	---	3	2	134
	11-38	0-10	1.40-1.65	6.00-20.00	0.06-0.10	0.0-2.9	5.0-10	.15	.15			
	38-80	0-10	1.30-1.60	6.00-20.00	0.04-0.08	0.0-2.9	5.0-10	.10	.15			
Bowstring-------	0-37	0-5	0.15-0.30	0.20-6.00	0.35-0.45	---	40-90	---	---	4	8	0
	37-47	0-10	1.40-1.60	0.60-20.00	0.05-0.07	0.0-2.9	---	---	---			
	47-80	0-5	0.15-0.30	0.20-6.00	0.35-0.45	---	---	---	---			
24A:												
Kinross---------	0-2	0-0	0.20-0.30	0.60-6.00	0.35-0.45	---	20-70	---	---	3	2	134
	2-20	0-10	1.40-1.70	6.00-20.00	0.04-0.09	0.0-2.9	1.0-4.0	.15	.15			
	20-80	0-10	1.40-1.70	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
Au Gres---------	0-9	0-8	1.30-1.55	6.00-20.00	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-24	0-8	1.50-1.70	6.00-20.00	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	24-80	0-8	1.50-1.70	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
26B:												
Cublake---------	0-8	0-8	1.35-1.60	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	8-31	0-10	1.35-1.65	6.00-20.00	0.05-0.12	0.0-2.9	0.0-1.0	.17	.17			
	31-56	0-10	1.40-1.70	6.00-20.00	0.04-0.11	0.0-2.9	1.0-2.0	.17	.17			
	56-80	8-35	1.40-1.80	0.20-0.60	0.12-0.18	0.0-2.9	0.0-0.5	.32	.32			
28B:												
East Lake-------	0-3	0-8	1.30-1.60	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	3-28	0-10	1.30-1.60	6.00-20.00	0.07-0.10	0.0-2.9	---	.15	.15			
	28-80	0-10	1.50-1.65	20.00-20.00	0.02-0.06	0.0-2.9	---	.10	.15			
32B:												
Kellogg---------	0-9	0-10	1.35-1.60	6.00-20.00	0.07-0.09	0.0-2.9	2.0-4.0	.15	.15	5	1	220
	9-32	2-12	1.35-1.60	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.15	.15			
	32-40	8-40	1.45-1.60	0.20-0.60	0.12-0.15	3.0-5.9	0.0-0.5	.32	.32			
	40-60	35-60	1.50-1.70	0.06-0.20	0.09-0.17	6.0-8.9	0.0-0.5	.32	.32			
	60-80	35-60	1.60-1.70	0.06-0.20	0.08-0.15	6.0-8.9	0.0-0.5	.32	.32			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
35:												
Kinross---------	0-2	0-0	0.20-0.30	0.60-6.00	0.35-0.45	---	20-70	---	---	3	2	134
	2-20	0-10	1.40-1.70	6.00-20.00	0.04-0.09	0.0-2.9	1.0-4.0	.15	.15			
	20-80	0-10	1.40-1.70	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
47D:												
Graycalm--------	0-3	0-10	1.30-1.55	6.00-20.00	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	3-31	0-10	1.25-1.60	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	31-80	0-15	1.50-1.65	6.00-20.00	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
48B, 48D, 48E:												
Rubicon---------	0-6	0-5	1.25-1.45	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	6-34	0-5	1.30-1.60	6.00-20.00	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	34-80	0-5	1.40-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
Graycalm--------	0-3	0-10	1.30-1.55	6.00-20.00	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	3-31	0-10	1.25-1.60	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	31-80	0-15	1.50-1.65	6.00-20.00	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
49B:												
Kalkaska--------	0-4	0-10	1.25-1.45	6.00-20.00	0.05-0.09	0.0-2.9	1.0-4.0	.15	.15	5	1	220
	4-6	0-15	1.35-1.45	6.00-20.00	0.06-0.08	0.0-2.9	1.0-3.0	.17	.17			
	6-50	0-10	1.35-1.45	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	50-80	0-10	1.35-1.50	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
49B3:												
Kalkaska--------	0-50	0-10	1.25-1.45	6.00-20.00	0.05-0.09	0.0-2.9	0.0-1.0	.15	.15	5	1	220
	50-80	0-10	1.35-1.50	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
49C, 49D, 49E:												
Kalkaska--------	0-4	0-10	1.25-1.45	6.00-20.00	0.05-0.09	0.0-2.9	1.0-4.0	.15	.15	5	1	220
	4-6	0-15	1.35-1.45	6.00-20.00	0.06-0.08	0.0-2.9	1.0-3.0	.17	.17			
	6-50	0-10	1.35-1.45	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	50-80	0-10	1.35-1.50	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
50B:												
Au Gres----------	0-9	0-8	1.30-1.55	6.00-20.00	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-24	0-8	1.50-1.70	6.00-20.00	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	24-80	0-8	1.50-1.70	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
Kinross----------	0-2	0-0	0.20-0.30	0.60-6.00	0.35-0.45	---	20-70	---	---	5	1	220
	2-20	0-10	1.40-1.70	6.00-20.00	0.04-0.09	0.0-2.9	1.0-4.0	.15	.15			
	20-80	0-10	1.40-1.70	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
Croswell---------	0-8	0-10	1.30-1.55	6.00-20.00	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	8-23	0-10	1.40-1.60	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	23-32	0-10	1.40-1.60	6.00-20.00	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	32-80	0-10	1.50-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
51:												
Tawas------------	0-7	---	0.30-0.55	0.20-6.00	0.35-0.45	---	40-60	---	---	2	2	134
	7-21	---	0.30-0.55	0.20-6.00	0.24-0.45	---	40-60	---	---			
	21-80	0-10	1.40-1.65	6.00-20.00	0.03-0.10	0.0-2.9	---	.15	.15			
Leafriver--------	0-14	---	0.10-0.25	0.60-6.00	0.35-0.50	---	50-90	---	---	5	2	134
	14-80	0-10	1.50-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.5-5.0	.15	.15			
53B, 53C:												
Negwegon---------	0-6	12-27	1.40-1.60	0.60-2.00	0.22-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	6-25	35-60	1.40-1.70	0.00-0.06	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
	25-80	18-60	1.40-1.70	0.00-0.06	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
54A:												
Algonquin--------	0-9	15-27	1.20-1.55	0.60-2.00	0.22-0.24	0.0-2.9	2.0-3.0	.37	.37	5	5	56
	9-36	35-60	1.40-1.60	0.06-0.20	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
	36-80	35-60	1.40-1.70	0.00-0.06	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
58A:												
Wakeley----------	0-7	---	0.10-0.25	0.60-6.00	0.35-0.45	---	40-60	---	---	5	2	134
	7-22	0-15	1.45-1.60	6.00-20.00	0.06-0.08	0.0-2.9	0.0-0.5	.10	.15			
	22-80	35-60	1.50-1.70	0.00-0.06	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			
Allendale--------	0-10	0-10	1.25-1.40	6.00-20.00	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	10-22	0-15	1.35-1.45	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.17	.17			
	22-80	35-60	1.45-1.70	0.00-0.06	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
75B, 75D, 75E:												
Rubicon---------	0-6	0-5	1.25-1.45	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	6-34	0-5	1.30-1.60	6.00-20.00	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	34-80	0-5	1.40-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
78.												
Pits, borrow												
81B, 81D, 81E, 81F:												
Grayling-------	0-3	0-10	1.30-1.65	6.00-20.00	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	3-30	0-10	1.30-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	30-80	0-10	1.45-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
83B, 83F:												
Udipsamments----	0-80	0-10	1.35-1.65	6.00-20.00	0.05-0.09	0.0-2.9	0.5-1.0	.15	.15	5	1	220
86:												
Histosols-------	0-80	---	---	0.20-6.00	---	---	50-70	---	---	3	2	134
Aquents---------	0-5	---	---	0.20-0.60	---	---	50-70	---	---	3	2	134
	5-8	0-10	1.35-1.60	6.00-20.00	0.09-0.11	0.0-3.0	0.0-0.5	.17	.17			
	8-80	0-5	1.45-1.70	6.00-20.00	0.05-0.09	0.0-3.0	0.0-0.5	.15	.15			
87:												
Ausable---------	0-11	0-0	0.20-0.30	0.20-6.00	0.35-0.45	---	70-90	---	---	3	2	134
	11-37	0-10	1.40-1.65	6.00-20.00	0.06-0.10	0.0-2.9	5.0-10	.15	.15			
	37-80	0-10	1.30-1.60	6.00-20.00	0.04-0.08	0.0-2.9	5.0-10	.10	.15			
99:												
Roscommon-------	0-9	0-10	0.20-0.30	0.20-6.00	0.35-0.45	0.0-2.9	40-60	---	---	1	2	134
	9-80	0-10	1.45-1.70	6.00-20.00	0.05-0.09	0.0-2.9	---	.15	.15			
131E:												
Rubicon---------	0-6	0-5	1.25-1.45	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	6-34	0-5	1.30-1.60	6.00-20.00	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	34-80	0-5	1.40-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
131E:												
Menominee-------	0-7	0-10	1.35-1.55	6.00-20.00	0.08-0.10	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	7-33	0-15	1.35-1.65	6.00-20.00	0.05-0.09	0.0-2.9	0.5-3.0	.10	.17			
	33-58	10-35	1.45-1.70	0.20-0.60	0.14-0.18	3.0-5.9	0.0-0.5	.28	.32			
	58-80	27-35	1.45-1.75	0.20-0.60	0.13-0.18	3.0-5.9	0.0-0.5	.32	.37			
147B, 147C, 147D, 147E:												
Lindquist------	0-5	0-5	1.30-1.55	6.00-20.00	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	5-34	0-5	1.35-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.1-1.0	.10	.15			
	34-39	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.1-1.0	.10	.15			
	39-77	2-12	1.55-1.65	6.00-20.00	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			
	77-80	0-5	1.40-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
159A:												
Finch-----------	0-2	0-5	1.20-1.50	6.00-20.00	0.07-0.09	0.0-2.9	2.0-10	.15	.15	2	1	220
	2-11	0-5	1.30-1.55	6.00-20.00	0.06-0.08	0.0-2.9	0.0-0.5	.15	.15			
	11-27	0-5	1.75-2.05	0.60-6.00	0.02-0.04	0.0-2.9	0.5-3.0	.15	.15			
	27-80	0-5	1.40-1.55	6.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.15	.15			
174A:												
Au Gres---------	0-9	0-8	1.30-1.55	6.00-20.00	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-24	0-8	1.50-1.70	6.00-20.00	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	24-80	0-8	1.50-1.70	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
Roscommon-------	0-9	0-10	0.20-0.30	0.20-6.00	0.35-0.45	0.0-2.9	40-60	.15	.15	1	2	134
	9-80	0-10	1.45-1.70	6.00-20.00	0.05-0.09	0.0-2.9	---	.17	.17			
197A:												
Gladwin---------	0-13	2-12	1.30-1.55	6.00-20.00	0.10-0.12	0.0-2.9	2.0-4.0	.17	.17	4	2	134
	13-17	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	0.6-1.0	.15	.15			
	17-32	5-18	1.50-1.70	2.00-6.00	0.12-0.14	0.0-2.9	0.6-1.0	.17	.17			
	32-80	0-15	1.50-1.65	20.00-20.00	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
338B, 338C, 338D, 338E:												
Islandlake-----	0-5	0-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	5-6	0-15	1.40-1.65	6.00-20.00	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	6-27	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	27-52	0-10	1.55-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	52-80	0-15	1.55-1.65	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
360:												
Wakeley---------	0-7	---	0.10-0.25	0.60-6.00	0.35-0.45	---	40-60	---	---	4	2	134
	7-22	0-15	1.45-1.60	6.00-20.00	0.06-0.08	0.0-2.9	0.0-0.5	.10	.15			
	22-80	35-60	1.50-1.70	0.00-0.06	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			
366B, 366C, 366D, 366E:												
Islandlake-----	0-5	0-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	5-6	0-15	1.40-1.65	6.00-20.00	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	6-27	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	27-52	0-10	1.55-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	52-80	0-15	1.55-1.65	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
Blue Lake------	0-6	3-12	1.35-1.60	6.00-20.00	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	---
	6-27	5-12	1.30-1.60	6.00-20.00	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	27-80	8-15	1.30-1.60	2.00-6.00	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
371:												
Springport------	0-8	15-27	1.10-1.40	0.20-0.60	0.22-0.24	0.0-2.9	2.0-5.0	.37	.37	5	6	48
	8-13	35-60	1.40-1.65	0.06-0.20	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
	13-80	35-60	1.40-1.70	0.00-0.06	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
380.												
Access denied												
402B, 402C:												
Islandlake------	0-9	3-15	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	9-18	3-15	1.40-1.65	6.00-20.00	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	18-45	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	45-80	0-15	1.55-1.65	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
406A:												
Winterfield-----	0-7	0-10	0.90-1.60	2.00-20.00	0.07-0.09	0.0-2.9	2.0-4.0	.17	.17	5	2	134
	7-21	0-10	1.50-1.60	2.00-20.00	0.09-0.11	0.0-2.9	0.0-0.5	.17	.17			
	21-80	0-5	1.55-1.65	6.00-20.00	0.05-0.07	0.0-2.9	1.0-3.0	.15	.15			
412A:												
Ingalls---------	0-8	2-10	1.25-1.40	6.00-20.00	0.07-0.10	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	8-26	3-15	1.35-1.45	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.17	.17			
	26-80	2-20	1.45-1.80	0.20-0.60	0.09-0.22	0.0-2.9	0.0-0.5	.43	.43			
Burleigh--------	0-9	0-8	1.35-1.50	2.00-6.00	0.08-0.12	0.0-2.9	4.0-8.0	.17	.17	4	2	134
	9-21	2-10	1.40-1.55	6.00-20.00	0.06-0.09	0.0-2.9	---	.17	.17			
	21-80	8-30	1.45-1.80	0.20-0.60	0.05-0.20	0.0-2.9	---	.43	.43			
454B, 454C, 454D:												
Springlake------	0-5	0-5	1.30-1.60	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	5-7	0-10	1.40-1.65	6.00-20.00	0.06-0.11	0.0-2.9	1.0-3.0	.17	.17			
	7-37	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.0-0.5	.15	.15			
	37-80	0-10	1.50-1.65	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
454E:												
Springlake------	0-5	0-5	1.30-1.60	6.00-20.00	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	5	2	134
	5-7	0-10	1.40-1.65	6.00-20.00	0.06-0.11	0.0-2.9	1.0-3.0	.17	.17			
	7-37	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.0-0.5	.15	.15			
	37-80	0-10	1.50-1.65	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
457B:												
Islandlake------	0-5	0-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	5-6	0-15	1.40-1.65	6.00-20.00	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	6-27	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	27-52	0-10	1.55-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	52-80	0-15	1.55-1.65	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
Southwells------	0-1	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	2.0-4.0	.17	.17	5	2	134
	1-3	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	0.1-0.5	.17	.17			
	3-25	0-15	1.30-1.70	6.00-20.00	0.06-0.11	0.0-2.9	0.5-1.0	.17	.17			
	25-65	5-20	1.30-1.70	2.00-6.00	0.08-0.13	0.0-2.9	0.1-0.5	.15	.15			
	65-72	5-15	1.55-1.75	2.00-6.00	0.11-0.13	0.0-2.9	0.1-0.5	.24	.24			
	72-80	0-15	1.55-1.75	6.00-20.00	0.05-0.10	0.0-2.9	0.1-0.5	.15	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
457C, 457D, 457E:												
Islandlake------	0-5	0-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	5-6	0-15	1.40-1.65	6.00-20.00	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	6-27	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	27-52	0-10	1.55-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	52-80	0-15	1.55-1.65	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
Southwells------	0-1	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	2.0-4.0	.17	.17	5	2	134
	1-3	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	0.1-0.5	.17	.17			
	3-25	0-15	1.30-1.70	6.00-20.00	0.06-0.11	0.0-2.9	0.5-1.0	.17	.17			
	25-66	5-20	1.30-1.70	2.00-6.00	0.08-0.13	0.0-2.9	0.1-0.5	.15	.15			
	66-73	5-15	1.55-1.75	2.00-6.00	0.11-0.13	0.0-2.9	0.1-0.5	.24	.24			
	73-80	0-15	1.55-1.75	6.00-20.00	0.05-0.10	0.0-2.9	0.1-0.5	.15	.15			
458D:												
Islandlake------	0-5	0-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	5-6	0-15	1.40-1.65	6.00-20.00	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	6-27	0-10	1.40-1.65	6.00-20.00	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	27-52	0-10	1.55-1.65	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	52-80	0-15	1.55-1.65	6.00-20.00	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
Menominee-------	0-7	0-10	1.35-1.55	6.00-20.00	0.08-0.10	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	7-33	0-15	1.35-1.65	6.00-20.00	0.05-0.09	0.0-2.9	0.5-3.0	.10	.17			
	33-58	10-35	1.45-1.70	0.20-0.60	0.14-0.18	3.0-5.9	0.0-0.5	.28	.32			
	58-80	27-35	1.45-1.75	0.20-0.60	0.13-0.18	3.0-5.9	0.0-0.5	.32	.37			
459B, 459D, 459E:												
Rubicon---------	0-6	0-4	1.30-1.55	6.00-20.00	0.06-0.08	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	6-38	0-4	1.40-1.60	6.00-20.00	0.05-0.07	0.0-2.9	0.5-1.0	.15	.15			
	38-67	0-4	1.50-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	67-80	0-10	1.50-1.65	6.00-20.00	0.04-0.12	0.0-2.9	0.0-0.5	.15	.15			
460B, 460C, 460D, 460E, 460F:												
Rubicon--------	0-6	0-4	1.30-1.55	6.00-20.00	0.06-0.08	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	6-38	0-4	1.40-1.60	6.00-20.00	0.05-0.07	0.0-2.9	0.5-1.0	.15	.15			
	38-67	0-4	1.50-1.65	6.00-20.00	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	67-80	0-10	1.50-1.65	6.00-20.00	0.04-0.12	0.0-2.9	0.0-0.5	.15	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
460B, 460C, 460D, 460E, 460F:												
Mancelona------	0-7	0-5	1.35-1.65	6.00-20.00	0.06-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	7-21	0-15	1.30-1.65	6.00-20.00	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	21-35	5-15	1.30-1.65	2.00-6.00	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	35-80	0-10	1.45-1.65	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
461A:												
Allendale-------	0-10	0-10	1.25-1.40	6.00-20.00	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	10-22	0-15	1.35-1.45	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.17	.17			
	22-80	35-60	1.45-1.70	0.00-0.06	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			
Springport------	0-8	15-27	1.10-1.40	0.20-0.60	0.22-0.24	0.0-2.9	2.0-5.0	.37	.37	5	6	48
	8-13	35-60	1.40-1.65	0.06-0.20	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
	13-80	35-60	1.40-1.70	0.00-0.06	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
462A:												
Allendale-------	0-10	0-10	1.25-1.40	6.00-20.00	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	10-22	0-15	1.35-1.45	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.17	.17			
	22-80	35-60	1.45-1.70	0.00-0.06	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			
Algonquin-------	0-9	15-27	1.20-1.55	0.60-2.00	0.22-0.24	0.0-2.9	2.0-3.0	.37	.37	5	6	48
	9-36	35-60	1.40-1.60	0.06-0.20	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
	36-80	35-60	1.40-1.70	0.00-0.06	0.11-0.20	6.0-8.9	0.0-0.5	.32	.32			
466B:												
Halfaday--------	0-4	0-15	1.25-1.45	6.00-20.00	0.09-0.12	0.0-2.9	0.5-2.0	.15	.15	5	2	134
	4-35	0-10	1.35-1.50	6.00-20.00	0.06-0.08	0.0-2.9	0.5-2.0	.15	.15			
	35-80	0-5	1.35-1.50	6.00-20.00	0.04-0.06	0.0-2.9	0.1-0.5	.15	.15			
467B, 467C:												
Morganlake------	0-7	1-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-2.0	.15	.15	5	2	134
	7-35	1-15	1.40-1.65	6.00-20.00	0.09-0.11	0.0-2.9	0.1-0.5	.15	.15			
	35-49	15-35	1.45-1.70	0.20-0.60	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
	49-66	15-35	1.45-1.70	0.20-0.60	0.15-0.19	3.0-5.9	0.0-0.5	.37	.43			
	66-80	0-15	1.55-1.65	6.00-20.00	0.05-0.13	0.0-2.9	0.0-0.5	.10	.15			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
467B, 467C:												
Woodman----------	0-9	10-20	1.50-1.67	2.00-6.00	0.16-0.18	0.0-2.9	1.0-3.0	.24	.24	5	3	86
	9-20	10-30	1.40-1.65	0.20-0.60	0.12-0.19	3.0-5.9	0.1-1.0	.32	.32			
	20-37	18-35	1.37-1.70	0.06-0.20	0.15-0.20	6.0-8.9	0.1-1.0	.32	.32			
	37-56	10-30	1.60-1.75	0.20-0.60	0.11-0.22	3.0-5.9	0.0-0.5	.32	.32			
	56-80	0-15	1.55-1.65	6.00-20.00	0.02-0.06	0.0-2.9	0.0-0.0	.10	.15			
Blue Lake--------	0-6	3-12	1.35-1.60	6.00-20.00	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	6-27	5-12	1.30-1.60	6.00-20.00	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	27-80	8-15	1.30-1.60	2.00-6.00	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
468F:												
Southwells-------	0-1	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	2.0-4.0	.17	.17	5	2	134
	1-3	0-15	1.35-1.65	6.00-20.00	0.07-0.12	0.0-2.9	0.1-0.5	.17	.17			
	3-25	0-15	1.30-1.70	6.00-20.00	0.06-0.11	0.0-2.9	0.5-1.0	.17	.17			
	25-66	5-20	1.30-1.70	2.00-6.00	0.08-0.13	0.0-2.9	0.1-0.5	.15	.15			
	66-73	5-15	1.55-1.75	2.00-6.00	0.11-0.13	0.0-2.9	0.1-0.5	.24	.24			
	73-80	0-15	1.55-1.75	6.00-20.00	0.05-0.10	0.0-2.9	0.1-0.5	.15	.15			
Mancelona--------	0-7	0-5	1.35-1.65	6.00-20.00	0.06-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	7-21	0-15	1.30-1.65	6.00-20.00	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	21-35	5-15	1.30-1.65	2.00-6.00	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	35-80	0-10	1.45-1.65	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
Dighton----------	0-8	8-15	1.35-1.55	2.00-6.00	0.13-0.15	0.0-2.9	1.0-3.0	.24	.24	4	3	86
	8-26	35-60	1.40-1.70	0.06-0.20	0.15-0.20	3.0-5.9	0.1-0.5	.32	.32			
	26-37	35-60	1.40-1.70	0.06-0.20	0.15-0.20	3.0-5.9	0.1-0.5	.32	.32			
	37-80	0-10	1.45-1.75	6.00-20.00	0.02-0.10	0.0-2.9	0.0-0.0	.10	.15			
469B:												
Hodenpyl---------	0-14	2-12	1.30-1.60	2.00-6.00	0.16-0.18	0.0-2.9	1.0-3.0	.24	.24	5	3	86
	14-34	8-18	1.35-1.70	2.00-6.00	0.12-0.19	0.0-2.9	0.0-0.5	.24	.24			
	34-80	0-15	1.55-1.65	2.00-6.00	0.04-0.13	0.0-2.9	0.0-0.5	.17	.17			
Montcalm---------	0-10	2-10	1.35-1.65	6.00-20.00	0.09-0.12	0.0-2.9	0.5-3.0	.17	.17	5	2	134
	10-23	0-15	1.30-1.60	6.00-20.00	0.09-0.10	0.0-2.9	0.5-2.0	.15	.17			
	23-46	5-18	1.30-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.15	.17			
	46-80	2-10	1.55-1.70	6.00-20.00	0.04-0.10	0.0-2.9	0.0-0.5	.15	.17			

Table 18.—Physical Properties of Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
471B:												
Mancelona-------	0-7	0-5	1.35-1.65	6.00-20.00	0.06-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	7-21	0-15	1.30-1.65	6.00-20.00	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	21-35	5-15	1.30-1.65	2.00-6.00	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	35-80	0-10	1.45-1.65	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
Blue Lake-------	0-6	3-12	1.35-1.60	6.00-20.00	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	6-27	5-12	1.30-1.60	6.00-20.00	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	27-80	8-15	1.30-1.60	2.00-6.00	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
472B:												
Morganlake------	0-7	1-10	1.30-1.55	6.00-20.00	0.07-0.12	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	7-35	1-15	1.40-1.65	6.00-20.00	0.09-0.11	0.0-2.9	0.1-0.5	.15	.15			
	35-49	15-35	1.45-1.70	0.20-0.60	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
	49-66	15-35	1.45-1.70	0.20-0.60	0.15-0.19	3.0-5.9	0.0-0.5	.37	.43			
	66-80	0-15	1.55-1.65	6.00-20.00	0.05-0.13	0.0-2.9	0.0-0.5	.10	.15			
488A:												
Allendale-------	0-10	0-10	1.25-1.40	6.00-20.00	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	10-22	0-15	1.35-1.45	6.00-20.00	0.06-0.10	0.0-2.9	0.6-1.0	.17	.17			
	22-80	35-60	1.45-1.70	0.00-0.06	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			
494:												
Gauld-----------	0-9	2-15	1.10-1.60	0.60-2.00	0.16-0.18	---	4.0-8.0	.24	.24	5	3	86
	9-22	6-22	1.45-1.70	0.60-2.00	0.15-0.22	---	0.0-0.5	.37	.24			
	22-80	0-15	1.50-1.65	0.60-2.00	0.07-0.20	---	0.0-0.5	.15	.24			
W.												
Water												

Table 19.—Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
13:					
Tawas-----------	0-7	80-120	---	4.5-7.8	0
	7-21	80-120	---	4.5-7.8	0
	21-80	1.0-3.0	---	5.6-8.4	0
Lupton----------	0-10	140-180	---	5.6-7.8	0
	10-80	140-180	---	5.6-7.8	0
14:					
Dawson----------	0-4	---	80-120	3.6-4.4	0
	4-20	---	150-230	3.6-4.4	0
	20-22	---	10-25	3.6-4.4	0
	22-80	1.0-2.0	---	4.5-6.5	0
Loxley----------	0-12	---	50-100	2.0-4.4	0
	12-80	---	50-120	2.0-4.4	0
15A:					
Croswell--------	0-8	---	1.0-5.0	3.6-6.5	0
	8-23	1.0-4.0	---	4.5-7.3	0
	23-32	1.0-3.0	---	4.5-7.3	0
	32-80	1.0-2.0	---	5.1-8.4	0
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-24	2.0-5.0	---	4.5-7.3	0
	24-80	1.0-2.0	---	5.1-7.3	0
16B, 16E:					
Graycalm--------	0-3	4.0-10	---	4.5-6.5	---
	3-31	2.0-4.0	---	4.5-7.3	---
	31-80	1.0-5.0	---	4.5-7.3	---
17A:					
Croswell--------	0-8	---	1.0-5.0	3.6-6.5	0
	8-23	1.0-4.0	---	4.5-7.3	0
	23-32	1.0-3.0	---	4.5-7.3	0
	32-80	1.0-2.0	---	5.1-8.4	0
18A:					
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-24	2.0-5.0	---	4.5-7.3	0
	24-80	1.0-2.0	---	5.1-7.3	0
19:					
Leafriver-------	0-14	100-180	---	4.5-7.3	0
	14-80	1.0-15	---	4.5-7.3	0
20B, 20D, 20F:					
Graycalm--------	0-3	4.0-10	---	4.5-6.5	---
	3-31	2.0-4.0	---	4.5-7.3	---
	31-80	1.0-5.0	---	4.5-7.3	---
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-30	---	1.0-4.0	3.5-5.5	0
	30-80	1.0-2.0	---	4.5-6.5	0

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	meq/100g	meq/100g	pH	Pct
21B, 21D, 21F:					
Graycalm--------	0-3	4.0-10	---	4.5-6.5	---
	3-31	2.0-4.0	---	4.5-7.3	---
	31-80	1.0-5.0	---	4.5-7.3	---
Klacking--------	0-2	---	2.0-14	4.5-6.0	0
	2-21	---	4.5-7.3	0	
	21-80	2.0-6.0	---	4.5-7.3	0
22B:					
Montcalm--------	0-10	3.0-10	---	5.1-7.3	0
	10-23	1.0-5.0	---	5.1-6.5	0
	23-46	1.0-5.0	---	5.1-6.5	0
	46-80	1.0-2.0	---	5.6-7.3	0
23:					
Ausable---------	0-11	140-180	---	6.1-7.3	0
	11-38	5.0-25	---	6.1-7.8	0
	38-80	5.0-25	---	6.1-7.8	0
Bowstring-------	0-37	---	---	5.6-8.4	---
	37-47	---	---	5.6-8.4	---
	47-80	---	---	5.6-8.4	---
24A:					
Kinross---------	0-2	---	100-140	3.6-5.0	0
	2-20	---	1.0-10	3.6-6.0	0
	20-80	1.0-2.0	---	4.5-6.5	0
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-24	2.0-5.0	---	4.5-7.3	0
	24-80	1.0-2.0	---	5.1-7.3	0
26B:					
Cublake---------	0-8	---	1.0-10	4.5-6.0	0
	8-31	---	0.0-10	4.5-6.0	0
	31-56	---	2.0-10	4.5-6.0	0
	56-80	2.0-20	---	5.1-7.3	0
28B:					
East Lake-------	0-3	1.0-5.0	---	5.6-7.3	0
	3-28	1.0-5.0	---	5.6-7.3	0
	28-80	1.0-2.0	---	7.4-8.4	10-25
32B:					
Kellogg---------	0-9	---	4.0-15	4.5-6.0	0
	9-32	---	1.0-5.0	4.5-6.0	0
	32-40	4.0-15	---	6.1-7.8	0
	40-60	10-25	---	6.1-7.8	0-5
	60-80	10-25	---	7.4-8.4	10-30
35:					
Kinross---------	0-2	---	100-140	3.6-5.0	0
	2-20	---	1.0-10	3.6-6.0	0
	20-80	1.0-2.0	---	4.5-6.5	0

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
47D:					
Graycalm--------	0-3	4.0-10	---	4.5-6.5	---
	3-31	2.0-4.0	---	4.5-7.3	---
	31-80	1.0-5.0	---	4.5-7.3	---
48B, 48D, 48E:					
Rubicon---------	0-6	---	1.0-6.0	4.5-6.0	0
	6-34	---	1.0-4.0	4.5-6.0	0
	34-80	1.0-2.0	---	4.5-6.5	0
Graycalm--------	0-3	4.0-10	---	4.5-6.5	---
	3-31	2.0-4.0	---	4.5-7.3	---
	31-80	1.0-5.0	---	4.5-7.3	---
49B:					
Kalkaska--------	0-4	---	1.0-15	3.6-6.0	0
	4-6	---	4.0-15	3.6-6.0	0
	6-50	---	2.0-5.0	4.5-6.0	0
	50-80	1.0-2.0	---	4.5-6.5	0
49B3:					
Kalkaska--------	0-50	---	1.0-15	3.6-6.0	0
	50-80	1.0-2.0	---	4.5-6.5	0
49C, 49D, 49E:					
Kalkaska--------	0-4	---	1.0-15	3.6-6.0	0
	4-6	---	4.0-15	3.6-6.0	0
	6-50	---	2.0-5.0	4.5-6.0	0
	50-80	1.0-2.0	---	4.5-6.5	0
50B:					
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-24	2.0-5.0	---	4.5-7.3	0
	24-80	1.0-2.0	---	5.1-7.3	0
Kinross---------	0-2	---	100-140	3.6-5.0	0
	2-20	---	1.0-10	3.6-6.0	0
	20-80	1.0-2.0	---	4.5-6.5	0
Croswell--------	0-8	---	1.0-5.0	3.6-6.5	0
	8-23	1.0-4.0	---	4.5-7.3	0
	23-32	1.0-3.0	---	4.5-7.3	0
	32-80	1.0-2.0	---	5.1-8.4	0
51:					
Tawas-----------	0-7	80-120	---	4.5-7.8	0
	7-21	80-120	---	4.5-7.8	0
	21-80	1.0-3.0	---	5.6-8.4	0
Leafriver-------	0-14	100-180	---	4.5-7.3	0
	14-80	1.0-15	---	4.5-7.3	0
53B, 53C:					
Negwegon--------	0-6	10-25	---	6.1-7.8	0
	6-25	10-20	---	6.1-7.8	0
	25-80	10-20	---	7.9-8.4	10-30

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
54A:					
Algonquin-------	0-9	10-25	---	6.6-7.3	0
	9-36	10-20	---	7.4-8.4	10-20
	36-80	10-20	---	7.9-8.4	10-30
58A:					
Wakeley---------	0-7	80-120	---	5.6-7.8	---
	7-22	1.0-10	---	5.6-7.8	0
	22-80	5.0-25	---	7.4-8.4	10-30
Allendale-------	0-10	4.0-20	---	4.5-7.3	0
	10-22	1.0-5.0	---	4.5-7.3	0
	22-80	8.0-25	---	6.1-8.4	10-30
75B, 75D, 75E:					
Rubicon---------	0-6	---	1.0-6.0	4.5-6.0	0
	6-34	---	1.0-4.0	4.5-6.0	0
	34-80	1.0-2.0	---	4.5-6.5	0
78.					
Pits, borrow					
81B, 81D, 81E, 81F:					
Grayling-------	0-3	---	2.0-14	3.5-5.5	0
	3-30	---	1.0-4.0	3.5-5.5	0
	30-80	1.0-2.0	---	4.5-6.5	0
83B, 83F:					
Udipsamments----	0-80	---	---	5.1-6.5	---
86:					
Histosols-------	0-80	---	---	---	---
Aquents---------	0-5	---	---	---	---
	5-8	1.0-4.0	---	5.6-8.4	0-10
	8-80	1.0-4.0	---	5.6-8.4	0-10
87:					
Ausable---------	0-11	140-180	---	6.1-7.3	0
	11-37	5.0-25	---	6.1-7.8	0
	37-80	5.0-25	---	6.1-7.8	0
99:					
Roscommon-------	0-9	80-120	---	4.5-5.5	0
	9-80	1.0-4.0	---	5.6-8.4	0-10
131E:					
Rubicon---------	0-6	---	1.0-6.0	4.5-6.0	0
	6-34	---	1.0-4.0	4.5-6.0	0
	34-80	1.0-2.0	---	4.5-6.5	0
Menominee-------	0-7	2.0-10	---	4.5-6.5	0
	7-33	2.0-10	---	4.5-6.5	0
	33-58	5.0-20	---	5.1-7.8	1-10
	58-80	5.0-25	---	6.1-8.4	10-30

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
147B, 147C, 147D, 147E:					
Lindquist------	0-5	---	5.0-10	4.5-5.5	0
	5-34	---	1.0-2.0	4.5-5.5	0
	34-39	---	1.0-4.0	4.5-6.0	0
	39-77	1.0-4.0	---	5.6-7.3	0
	77-80	1.0-4.0	---	5.6-7.3	0
159A:					
Finch-----------	0-2	---	5.0-10	4.5-6.0	---
	2-11	---	1.0-2.0	4.5-6.0	---
	11-27	1.0-4.0	---	4.5-6.5	---
	27-80	1.0-4.0	---	5.6-7.8	---
174A:					
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-24	2.0-5.0	---	4.5-7.3	0
	24-80	1.0-2.0	---	5.1-7.3	0
Roscommon-------	0-9	80-120	---	4.5-5.5	0
	9-80	1.0-4.0	---	5.6-8.4	0-10
197A:					
Gladwin---------	0-13	4.0-15	---	6.1-7.8	0
	13-17	1.0-5.0	---	6.1-7.8	0
	17-32	2.0-10	---	6.6-7.8	0-2
	32-80	1.0-2.0	---	7.9-8.4	10-25
338B, 338C, 338D, 338E:					
Islandlake-----	0-5	---	1.0-9.0	4.5-6.0	0
	5-6	---	2.0-10	4.5-6.0	0
	6-27	---	1.0-6.0	4.5-6.0	0
	27-52	0.0-5.0	---	5.1-7.3	0
	52-80	0.0-7.0	---	6.1-7.8	0
360:					
Wakeley---------	0-7	80-120	---	5.6-7.8	---
	7-22	1.0-10	---	5.6-7.8	0
	22-80	5.0-25	---	7.4-8.4	10-30
366B, 366C, 366D, 366E:					
Islandlake-----	0-5	---	1.0-9.0	4.5-6.0	0
	5-6	---	2.0-10	4.5-6.0	0
	6-27	---	1.0-6.0	4.5-6.0	0
	27-52	0.0-5.0	---	5.1-7.3	0
	52-80	0.0-7.0	---	6.1-7.8	0
Blue Lake------	0-6	2.0-7.0	---	5.1-6.5	0
	6-27	2.0-6.0	---	5.1-6.5	0
	27-80	1.0-8.0	---	5.1-6.5	0
371:					
Springport------	0-8	15-30	---	6.6-7.3	0
	8-13	10-20	---	7.4-8.4	0
	13-80	10-20	---	7.4-8.4	10-30

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
380. Access denied					
402B, 402C:					
Islandlake------	0-9	---	1.0-9.0	4.5-6.0	0
	9-18	---	2.0-10	4.5-6.0	0
	18-45	---	1.0-6.0	4.5-6.0	0
	45-80	0.0-7.0	---	5.6-7.8	0
406A:					
Winterfield-----	0-7	2.0-15	---	5.6-7.8	0-5
	7-21	1.0-10	---	5.6-7.8	0-5
	21-80	1.0-5.0	---	5.6-8.4	0-5
412A:					
Ingalls---------	0-8	3.0-15	---	4.5-7.3	0
	8-26	1.0-10	---	4.5-7.3	0
	26-80	1.0-15	---	5.6-8.4	---
Burleigh--------	0-9	10-20	---	6.1-7.8	0
	9-21	1.0-5.0	---	6.1-7.8	0
	21-80	2.0-20	---	7.4-8.4	5-30
454B, 454C, 454D, 454E:					
Springlake-----	0-5	2.0-10	---	5.6-6.5	0
	5-7	1.0-4.0	---	5.6-6.5	0
	7-37	1.0-4.0	---	5.6-7.8	0
	37-80	1.0-4.0	---	7.4-8.4	10-25
457B:					
Islandlake------	0-5	---	1.0-9.0	4.5-6.0	0
	5-6	---	2.0-10	4.5-6.0	0
	6-27	---	1.0-6.0	4.5-6.0	0
	27-52	0.0-5.0	---	5.1-7.3	0
	52-80	0.0-7.0	---	6.1-7.8	0
Southwells------	0-1	---	5.0-15	4.5-6.0	0
	1-3	---	1.0-5.0	4.5-6.0	0
	3-25	---	2.0-7.0	5.1-6.0	0
	25-65	1.0-10	---	5.6-7.3	0
	65-72	1.0-5.0	---	7.4-8.4	0
	72-80	1.0-5.0	---	7.4-8.4	0
457C, 457D, 457E:					
Islandlake------	0-5	---	1.0-9.0	4.5-6.0	0
	5-6	---	2.0-10	4.5-6.0	0
	6-27	---	1.0-6.0	4.5-6.0	0
	27-52	0.0-5.0	---	5.1-7.3	0
	52-80	0.0-7.0	---	6.1-7.8	0
Southwells------	0-1	---	5.0-15	4.5-6.0	0
	1-3	---	1.0-5.0	4.5-6.0	0
	3-25	---	2.0-7.0	5.1-6.0	0
	25-66	1.0-10	---	5.6-7.3	0
	66-73	1.0-5.0	---	7.4-8.4	0
	73-80	1.0-5.0	---	7.4-8.4	0

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
458D:					
Islandlake------	0-5	---	1.0-9.0	4.5-6.0	0
	5-6	---	2.0-10	4.5-6.0	0
	6-27	---	1.0-6.0	4.5-6.0	0
	27-52	0.0-5.0	---	5.1-7.3	0
	52-80	0.0-7.0	---	6.1-7.8	0
Menominee-------	0-7	2.0-10	---	4.5-6.5	0
	7-33	2.0-10	---	4.5-6.5	0
	33-58	5.0-20	---	5.1-7.8	1-10
	58-80	5.0-25	---	6.1-8.4	10-30
459B, 459D, 459E:					
Rubicon---------	0-6	2.0-10	---	4.5-6.5	0
	6-38	1.0-2.0	---	4.5-6.5	0
	38-67	1.0-2.0	---	5.1-6.5	0
	67-80	1.0-8.0	---	7.4-8.4	5-20
460B, 460C, 460D, 460E, 460F:					
Rubicon--------	0-6	2.0-10	---	4.5-6.5	0
	6-38	1.0-2.0	---	4.5-6.5	0
	38-67	1.0-2.0	---	5.1-6.5	0
	67-80	1.0-8.0	---	7.4-8.4	5-20
Mancelona------	0-7	2.0-10	---	5.1-7.3	0
	7-21	1.0-10	---	5.6-7.8	0
	21-35	4.0-15	---	6.1-7.8	---
	35-80	1.0-4.0	---	7.4-8.4	10-25
461A:					
Allendale-------	0-10	4.0-20	---	4.5-7.3	0
	10-22	1.0-5.0	---	4.5-7.3	0
	22-80	8.0-25	---	6.1-8.4	10-30
Springport------	0-8	15-30	---	6.6-7.3	0
	8-13	10-20	---	7.4-8.4	0
	13-80	10-20	---	7.4-8.4	10-30
462A:					
Allendale-------	0-10	4.0-20	---	4.5-7.3	0
	10-22	1.0-5.0	---	4.5-7.3	0
	22-80	8.0-25	---	6.1-8.4	10-30
Algonquin-------	0-9	10-25	---	6.6-7.3	0
	9-36	10-20	---	7.4-8.4	10-20
	36-80	10-20	---	7.9-8.4	10-30
466B:					
Halfaday--------	0-4	2.0-10	---	4.5-6.5	0
	4-35	1.0-5.0	---	4.5-6.5	0
	35-80	1.0-5.0	---	5.1-7.3	0

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
467B, 467C:					
Morganlake------	0-7	---	2.0-7.0	3.5-7.3	0
	7-35	2.0-10	1.0-4.0	3.5-6.0	0
	35-49	5.0-14	---	5.6-7.8	0
	49-66	2.0-10	---	7.4-8.4	10-30
	66-80	1.0-2.0	---	5.6-7.8	0-10
Woodman---------	0-9	2.0-10	---	5.6-6.5	0
	9-20	2.0-10	---	5.6-7.3	0
	20-37	10-20	---	6.1-7.8	0
	37-56	2.0-10	---	6.6-8.4	20-30
	56-80	0-2.0	---	6.1-8.4	0-20
Blue Lake-------	0-6	2.0-7.0	---	5.1-6.5	0
	6-27	2.0-6.0	---	5.1-6.5	0
	27-80	1.0-8.0	---	5.1-6.5	0
468F:					
Southwells------	0-1	---	5.0-15	4.5-6.0	0
	1-3	---	1.0-5.0	4.5-6.0	0
	3-25	---	2.0-7.0	5.1-6.0	0
	25-66	1.0-10	---	5.6-7.3	0
	66-73	1.0-5.0	---	7.4-8.4	0
	73-80	1.0-5.0	---	7.4-8.4	0
Mancelona-------	0-7	2.0-10	---	5.1-7.3	0
	7-21	1.0-10	---	5.6-7.8	0
	21-35	4.0-15	---	6.1-7.8	---
	35-80	1.0-4.0	---	7.4-8.4	10-25
Dighton---------	0-8	2.0-10	---	6.1-7.8	0
	8-26	5.0-14	---	6.1-7.8	0
	26-37	5.0-14	---	7.9-8.4	20-30
	37-80	1.0-2.0	---	6.1-8.4	0-10
469B:					
Hodenpyl--------	0-14	2.0-10	---	5.1-6.5	0
	14-34	2.0-10	---	4.5-6.5	0
	34-80	1.0-4.0	---	4.5-7.3	0
Montcalm--------	0-10	3.0-10	---	5.1-7.3	0
	10-23	1.0-5.0	---	5.1-6.5	0
	23-46	1.0-5.0	---	5.1-6.5	0
	46-80	1.0-2.0	---	5.6-7.3	0
471B:					
Mancelona-------	0-7	2.0-10	---	5.1-7.3	0
	7-21	1.0-10	---	5.6-7.8	0
	21-35	4.0-15	---	6.1-7.8	---
	35-80	1.0-4.0	---	7.4-8.4	10-25
Blue Lake-------	0-6	2.0-7.0	---	5.1-6.5	0
	6-27	2.0-6.0	---	5.1-6.5	0
	27-80	1.0-8.0	---	5.1-6.5	0

Table 19.—Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equiv-alent
	In	meq/100g	meq/100g	pH	Pct
472B:					
Morganlake------	0-7	---	2.0-7.0	3.5-7.3	0
	7-35	2.0-10	1.0-4.0	3.5-6.0	0
	35-49	5.0-14	---	5.6-7.8	0
	49-66	2.0-10	---	7.4-8.4	10-30
	66-80	1.0-2.0	---	5.6-7.8	0-10
488A:					
Allendale-------	0-10	4.0-20	---	4.5-7.3	0
	10-22	1.0-5.0	---	4.5-7.3	0
	22-80	8.0-25	---	6.1-8.4	10-30
494:					
Gauld-----------	0-9	10-25	---	6.1-7.3	0
	9-22	2.0-10	---	6.6-7.8	5-30
	22-80	1.0-10	---	7.4-8.4	10-30
W.					
Water					

Table 20.—Soil Moisture Status by Depth

(Depths of layers are in feet)

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
13:												
Tawas---------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Lupton--------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
14:												
Dawson--------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Loxley--------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
15A:												
Croswell------	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
Au Gres-------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
16B, 16E:												
Graycalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
17A:												
Croswell------	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Unknown	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
18A:												
Au Gres-------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
19:												
Leafriver-----	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
20B, 20D, 20F:												
Graycalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Grayling------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
21B, 21D, 21F:												
Graycalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
21B, 21D, 21F:												
Klacking------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
22B:												
Montcalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
23:												
Ausable-------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Bowstring-----	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
24A:												
Kinross-------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Au Gres-------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
26B:												
Cublake-------	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
28B:												
East Lake-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
32B:												
Kellogg-------	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-3.0: Moist 3.0-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
35:												
Kinross-------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
47D:												
Graycalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
48B, 48D, 48E:												
Rubicon-------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Graycalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
49B, 49B3, 49C, 49D, 49E:												
Kalkaska-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
50B:												
Au Gres-------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
Kinross-------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Croswell------	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Unknown	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
51:												
Tawas---------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Leafriver-----	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
53B, 53C: Negwegon------	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.0: Moist 1.0-3.0: Wet 3.0-6.5: Moist	0.0-1.0: Moist 1.0-3.0: Wet 3.0-6.5: Moist	0.0-1.0: Moist 1.0-3.0: Wet 3.0-6.5: Moist	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Moist 1.0-3.0: Wet 3.0-6.5: Moist	0.0-1.0: Moist 1.0-3.0: Wet 3.0-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---
54A: Algonquin-----	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist
58A: Wakeley-------	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.5: Moist 1.5-2.0: Wet 2.0-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---
Allendale-----	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist
75B, 75D, 75E: Rubicon-------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
78. Pits, borrow												

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
81B, 81D, 81E, 81F:												
Grayling-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
83B, 83F:												
Udipsamments--	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
86:												
Histosols-----	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet
Aquents-------	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet
87:												
Ausable-------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
99:												
Roscommon-----	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
131E:												
Rubicon-------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Menominee-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
147B, 147C, 147D, 147E:												
Lindquist----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
159A:												
Finch---------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
174A:												
Au Gres-------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
Roscommon-----	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
197A:												
Gladwin-------	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
338B, 338C, 338D, 338E:												
Islandlake---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
360:												
Wakeley-------	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.5: Moist 1.5-2.0: Wet 2.0-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---	0.0-2.0: Wet 2.0-6.5: Moist ---
366B, 366C, 366D, 366E:												
Islandlake---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Blue Lake----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
371:												
Springport----	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---
380. Access denied												
402B, 402C:												
Islandlake----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
406A:												
Winterfield---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
412A:												
Ingalls-------	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---
Burleigh------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
454B, 454C, 454D, 454E:												
Springlake---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
457B, 457C, 457D, 457E:												
Islandlake---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Southwells---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
458D:												
Islandlake----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Menominee-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
459B, 459D, 459E:												
Rubicon------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
460B, 460C, 460D, 460E, 460F:												
Rubicon------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Mancelona----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	--- 0.0-6.5: Moist
461A:												
Allendale-----	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
461A:												
Springport	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---	0.0-1.5: Wet 1.5-6.5: Moist ---
462A:												
Allendale	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist
Algonquin	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist
466B:												
Halfaday	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
467B, 467C:												
Morganlake	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-3.0: Dry 3.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-6.5: Moist --- ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
467B, 467C:												
Woodman-------	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.0: Wet 3.0-6.5: Moist	0.0-1.5: Moist 1.5-3.0: Wet 3.0-6.5: Moist	0.0-1.5: Moist 1.5-3.0: Wet 3.0-6.5: Moist	0.0-2.5: Moist 2.5-3.0: Wet 3.0-6.5: Moist	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-3.0: Dry 3.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.0: Wet 3.0-6.5: Moist	0.0-1.5: Moist 1.5-3.0: Wet 3.0-6.5: Moist	0.0-6.5: Moist --- ---
Blue Lake-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
468F:												
Southwells----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Mancelona-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Dighton-------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-2.0: Dry 2.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
469B:												
Hodenpyl------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Montcalm------	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 20.—Soil Moisture Status by Depth—Continued

Map symbol and soil name	January	February	March	April	May	June	July	August	Sept.	October	November	December
471B:												
Mancelona-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Blue Lake-----	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
472B:												
Morganlake----	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-3.0: Wet 3.0-6.5: Moist	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-3.0: Dry 3.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.5: Moist	0.0-6.5: Moist --- ---
488A:												
Allendale-----	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-0.5: Moist 0.5-2.0: Wet 2.0-6.5: Moist	0.0-1.0: Moist 1.0-2.0: Wet 2.0-6.5: Moist
494:												
Gauld---------	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
W.												
Water												

Table 21.—Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydro-logic group	Month	Water table			Ponding			Flooding	
			Upper limit	Lower limit	Kind	Surface water depth	Duration	Frequency	Duration	Frequency
13:										
Tawas-----------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
Lupton----------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
14:										
Dawson----------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
Loxley----------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
15A:										
Croswell--------	A									
		January	5.0	> 6.5	Apparent	---	---	---	---	---
		February	5.0	> 6.5	Apparent	---	---	---	---	---
		March	2.5	> 6.5	Apparent	---	---	---	---	---
		April	2.0	> 6.5	Apparent	---	---	---	---	---
		May	2.0	> 6.5	Apparent	---	---	---	---	---
		June	3.5	> 6.5	Apparent	---	---	---	---	---
		September	4.5	> 6.5	Apparent	---	---	---	---	---
		October	3.0	> 6.5	Apparent	---	---	---	---	---
		November	2.5	> 6.5	Apparent	---	---	---	---	---
		December	2.0	> 6.5	Apparent	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
15A:										
Au Gres---------	B									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
16B, 16E:										
Graycalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
17A:										
Croswell--------	A									
		January	5.0	> 6.5	Apparent	---	---	---	---	---
		February	5.0	> 6.5	Apparent	---	---	---	---	---
		March	2.5	> 6.5	Apparent	---	---	---	---	---
		April	2.0	> 6.5	Apparent	---	---	---	---	---
		May	2.0	> 6.5	Apparent	---	---	---	---	---
		June	3.5	> 6.5	Apparent	---	---	---	---	---
		September	4.5	> 6.5	Apparent	---	---	---	---	---
		November	2.5	> 6.5	Apparent	---	---	---	---	---
		December	2.0	> 6.5	Apparent	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
18A:										
Au Gres----------	B									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
19:										
Leafriver-------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
20B, 20D, 20F:										
Graycalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Grayling--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
21B, 21D, 21F:										
Graycalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Klacking--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
22B:										
Montcalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
23:										
Ausable---------	D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		June	0.0	> 6.5	Apparent	---	---	---	Long	Frequent
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
Bowstring-------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		June	0.0	> 6.5	Apparent	---	---	---	Long	Frequent
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydrologic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
24A:										
Kinross---------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	---	---	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
Au Gres---------	B									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
26B:										
Cublake---------	A									
		January	5.0	> 6.5	Apparent	---	---	---	---	---
		February	5.0	> 6.5	Apparent	---	---	---	---	---
		March	2.5	> 6.5	Apparent	---	---	---	---	---
		April	2.0	> 6.5	Apparent	---	---	---	---	---
		May	2.0	> 6.5	Apparent	---	---	---	---	---
		June	3.5	> 6.5	Apparent	---	---	---	---	---
		September	4.5	> 6.5	Apparent	---	---	---	---	---
		October	3.0	> 6.5	Apparent	---	---	---	---	---
		November	2.5	> 6.5	Apparent	---	---	---	---	---
		December	2.0	> 6.5	Apparent	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
28B:										
East Lake-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
32B:										
Kellogg---------	A									
		March	3.0	3.5	Perched	---	---	---	---	---
		April	3.0	3.5	Perched	---	---	---	---	---
		May	3.0	3.5	Perched	---	---	---	---	---
		June	3.0	3.5	Perched	---	---	---	---	---
		September	3.0	3.5	Perched	---	---	---	---	---
		October	3.0	3.5	Perched	---	---	---	---	---
		November	3.0	3.5	Perched	---	---	---	---	---
35:										
Kinross---------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	---	---	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
47D:										
Graycalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
48B, 48D, 48E:										
Rubicon---------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Graycalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
49B, 49B3, 49C, 49D, 49E:										
Kalkaska-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
50B:										
Au Gres---------	B									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
Kinross---------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	---	---	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table			Ponding			Flooding	
			Upper limit	Lower limit	Kind	Surface water depth	Duration	Frequency	Duration	Frequency
50B:										
Croswell--------	A									
		January	5.0	> 6.5	Apparent	---	---	---	---	---
		February	5.0	> 6.5	Apparent	---	---	---	---	---
		March	2.5	> 6.5	Apparent	---	---	---	---	---
		April	2.0	> 6.5	Apparent	---	---	---	---	---
		May	2.0	> 6.5	Apparent	---	---	---	---	---
		June	3.5	> 6.5	Apparent	---	---	---	---	---
		September	4.5	> 6.5	Apparent	---	---	---	---	---
		November	2.5	> 6.5	Apparent	---	---	---	---	---
		December	2.0	> 6.5	Apparent	---	---	---	---	---
51:										
Tawas-----------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
Leafriver-------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	---	---	---	---	---
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydrologic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
53B, 53C:										
Negwegon--------	C									
		March	1.0	3.0	Perched	---	---	---	---	---
		April	1.0	3.0	Perched	---	---	---	---	---
		May	1.0	3.0	Perched	---	---	---	---	---
		September	1.0	3.0	Perched	---	---	---	---	---
		October	1.0	3.0	Perched	---	---	---	---	---
54A:										
Algonquin-------	D									
		January	1.0	1.5	Perched	---	---	---	---	---
		February	1.0	1.5	Perched	---	---	---	---	---
		March	0.5	1.5	Perched	---	---	---	---	---
		April	0.5	1.5	Perched	---	---	---	---	---
		May	0.5	1.5	Perched	---	---	---	---	---
		October	0.5	1.5	Perched	---	---	---	---	---
		November	0.5	1.5	Perched	---	---	---	---	---
		December	1.0	1.5	Perched	---	---	---	---	---
58A:										
Wakeley---------	D									
		January	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		February	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		March	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		April	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		May	0.5	2.0	Perched	0.0-1.0	---	---	---	---
		June	1.5	2.0	Perched	---	---	---	---	---
		September	0.0	2.0	Perched	---	---	---	---	---
		October	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		November	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		December	0.0	2.0	Perched	0.0-1.0	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
58A:										
Allendale-------	C									
		January	1.0	2.0	Perched	---	---	---	---	---
		February	1.0	2.0	Perched	---	---	---	---	---
		March	0.5	2.0	Perched	---	---	---	---	---
		April	0.5	2.0	Perched	---	---	---	---	---
		May	0.5	2.0	Perched	---	---	---	---	---
		June	1.0	2.0	Perched	---	---	---	---	---
		September	1.0	2.0	Perched	---	---	---	---	---
		October	0.5	2.0	Perched	---	---	---	---	---
		November	0.5	2.0	Perched	---	---	---	---	---
		December	1.0	2.0	Perched	---	---	---	---	---
75B, 75D, 75E:										
Rubicon---------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
78.										
Pits, borrow										
81B, 81D, 81E, 81F:										
Grayling-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
83B, 83F:										
Udipsamments----	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
86:										
Histosols-------	D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		July	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		August	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		September	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
Aquents---------	D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		July	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		August	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		September	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
87:										
Ausable	D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		April	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		May	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	Long	Frequent
		June	0.0	> 6.5	Apparent	---	---	---	Long	Frequent
		July	0.5	> 6.5	Apparent	---	---	---	---	---
		August	0.5	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	---	---	---	---	---
		October	0.0	> 6.5	Apparent	---	---	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Very long	---	---	---
99:										
Roscommon	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
131E:										
Rubicon	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Menominee	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
147B, 147C, 147D, 147E:										
Lindquist	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
159A:										
Finch-----------	C									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
174A:										
Au Gres---------	B									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydrologic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
174A:										
Roscommon-------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
197A:										
Gladwin---------	A									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
338B, 338C, 338D, 338E:										
Islandlake-----	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table			Ponding			Flooding	
			Upper limit	Lower limit	Kind	Surface water depth	Duration	Frequency	Duration	Frequency
360:										
Wakeley---------	D									
		January	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		February	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		March	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		April	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		May	0.5	2.0	Perched	0.0-1.0	---	---	---	---
		June	1.5	2.0	Perched	---	---	---	---	---
		September	0.0	2.0	Perched	---	---	---	---	---
		October	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		November	0.0	2.0	Perched	0.0-1.0	---	---	---	---
		December	0.0	2.0	Perched	0.0-1.0	---	---	---	---
366B, 366C, 366D, 366E:										
Islandlake-----	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Blue Lake------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
371:										
Springport------	D									
		January	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		February	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		March	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		April	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		May	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		June	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		July	1.0	1.5	Perched	---	---	---	---	---
		August	1.0	1.5	Perched	---	---	---	---	---
		September	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		October	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		November	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		December	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
380.										
Access denied										

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
402B, 402C:										
Islandlake------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
406A:										
Winterfield-----	A/D									
		January	1.5	> 6.5	Apparent	---	---	---	---	---
		February	1.5	> 6.5	Apparent	---	---	---	---	---
		March	1.0	> 6.5	Apparent	---	---	---	Long	Rare
		April	0.5	> 6.5	Apparent	---	---	---	Long	Rare
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		July	2.0	> 6.5	Apparent	---	---	---	---	---
		August	3.0	> 6.5	Apparent	---	---	---	---	---
		September	2.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.5	> 6.5	Apparent	---	---	---	---	---
412A:										
Ingalls---------	B									
		January	1.0	> 6.5	Apparent	---	---	---	---	---
		February	1.0	> 6.5	Apparent	---	---	---	---	---
		March	0.5	> 6.5	Apparent	---	---	---	---	---
		April	0.5	> 6.5	Apparent	---	---	---	---	---
		May	0.5	> 6.5	Apparent	---	---	---	---	---
		June	1.0	> 6.5	Apparent	---	---	---	---	---
		September	1.0	> 6.5	Apparent	---	---	---	---	---
		October	1.0	> 6.5	Apparent	---	---	---	---	---
		November	1.0	> 6.5	Apparent	---	---	---	---	---
		December	1.0	> 6.5	Apparent	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
412A:										
Burleigh--------	A/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	---	---	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	6.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
454B, 454C, 454D, 454E:										
Springlake-----	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
457B, 457C, 457D, 457E:										
Islandlake-----	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Southwells-----	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
458D:										
Islandlake------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Menominee-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
459B, 459D, 459E:										
Rubicon---------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
460B, 460C, 460D, 460E, 460F:										
Rubicon--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Mancelona------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
461A:										
Allendale-------	C									
		January	1.0	2.0	Perched	---	---	---	---	---
		February	1.0	2.0	Perched	---	---	---	---	---
		March	0.5	2.0	Perched	---	---	---	---	---
		April	0.5	2.0	Perched	---	---	---	---	---
		May	0.5	2.0	Perched	---	---	---	---	---
		June	1.0	2.0	Perched	---	---	---	---	---
		September	1.0	2.0	Perched	---	---	---	---	---
		October	0.5	2.0	Perched	---	---	---	---	---
		November	0.5	2.0	Perched	---	---	---	---	---
		December	1.0	2.0	Perched	---	---	---	---	---
Springport------	D									
		January	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		February	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		March	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		April	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		May	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		June	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		July	1.0	1.5	Perched	---	---	---	---	---
		August	1.0	1.5	Perched	---	---	---	---	---
		September	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		October	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		November	0.0	1.5	Perched	0.0-1.0	Long	---	---	---
		December	0.0	1.5	Perched	0.0-1.0	Long	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
462A:										
Allendale-------	C									
		January	1.0	2.0	Perched	---	---	---	---	---
		February	1.0	2.0	Perched	---	---	---	---	---
		March	0.5	2.0	Perched	---	---	---	---	---
		April	0.5	2.0	Perched	---	---	---	---	---
		May	0.5	2.0	Perched	---	---	---	---	---
		June	1.0	2.0	Perched	---	---	---	---	---
		September	1.0	2.0	Perched	---	---	---	---	---
		October	0.5	2.0	Perched	---	---	---	---	---
		November	0.5	2.0	Perched	---	---	---	---	---
		December	1.0	2.0	Perched	---	---	---	---	---
Algonquin-------	D									
		January	1.0	1.5	Perched	---	---	---	---	---
		February	1.0	1.5	Perched	---	---	---	---	---
		March	0.5	1.5	Perched	---	---	---	---	---
		April	0.5	1.5	Perched	---	---	---	---	---
		May	0.5	1.5	Perched	---	---	---	---	---
		October	0.5	1.5	Perched	---	---	---	---	---
		November	0.5	1.5	Perched	---	---	---	---	---
		December	1.0	1.5	Perched	---	---	---	---	---
466B:										
Halfaday--------	A									
		January	5.0	> 6.5	Apparent	---	---	---	---	---
		February	5.0	> 6.5	Apparent	---	---	---	---	---
		March	2.5	> 6.5	Apparent	---	---	---	---	---
		April	2.0	> 6.5	Apparent	---	---	---	---	---
		May	2.0	> 6.5	Apparent	---	---	---	---	---
		June	3.5	> 6.5	Apparent	---	---	---	---	---
		September	4.5	> 6.5	Apparent	---	---	---	---	---
		October	3.0	> 6.5	Apparent	---	---	---	---	---
		November	2.5	> 6.5	Apparent	---	---	---	---	---
		December	2.0	> 6.5	Apparent	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
467B:										
Morganlake------	B									
		March	2.5	4.0	Perched	---	---	---	---	---
		April	2.5	4.0	Perched	---	---	---	---	---
		May	2.5	4.0	Perched	---	---	---	---	---
		June	2.5	4.0	Perched	---	---	---	---	---
		October	2.5	4.0	Perched	---	---	---	---	---
		November	2.5	4.0	Perched	---	---	---	---	---
Woodman---------	C									
		March	1.5	3.0	Perched	---	---	---	---	---
		April	1.5	3.0	Perched	---	---	---	---	---
		May	1.5	3.0	Perched	---	---	---	---	---
		June	2.5	3.0	Perched	---	---	---	---	---
		October	1.5	3.0	Perched	---	---	---	---	---
		November	1.5	3.0	Perched	---	---	---	---	---
Blue Lake-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
467C:										
Morganlake------	B									
		March	2.5	4.0	Perched	---	---	---	---	---
		April	2.5	4.0	Perched	---	---	---	---	---
		May	2.5	4.0	Perched	---	---	---	---	---
		June	2.5	3.0	Perched	---	---	---	---	---
		October	2.5	4.0	Perched	---	---	---	---	---
		November	2.5	4.0	Perched	---	---	---	---	---
Woodman---------	C									
		March	1.5	3.0	Perched	---	---	---	---	---
		April	1.5	3.0	Perched	---	---	---	---	---
		May	1.5	3.0	Perched	---	---	---	---	---
		June	2.5	3.0	Perched	---	---	---	---	---
		October	1.5	3.0	Perched	---	---	---	---	---
		November	1.5	3.0	Perched	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
467C:										
Blue Lake-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
468F:										
Southwells------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Mancelona-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Dighton---------	C									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
469B:										
Hodenpyl--------	B									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Montcalm--------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
471B:										
Mancelona-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
Blue Lake-------	A									
		All months	> 6.5	> 6.5	---	---	---	---	---	---
472B:										
Morganlake------	B									
		March	2.5	4.0	Perched	---	---	---	---	---
		April	2.5	4.0	Perched	---	---	---	---	---
		May	2.5	4.0	Perched	---	---	---	---	---
		June	2.5	4.0	Perched	---	---	---	---	---
		October	2.5	4.0	Perched	---	---	---	---	---
		November	2.5	4.0	Perched	---	---	---	---	---

Table 21.—Water Features—Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
488A:										
Allendale-------	C									
		January	1.0	2.0	Perched	---	---	---	---	---
		February	1.0	2.0	Perched	---	---	---	---	---
		March	0.5	2.0	Perched	---	---	---	---	---
		April	0.5	2.0	Perched	---	---	---	---	---
		May	0.5	2.0	Perched	---	---	---	---	---
		June	1.0	2.0	Perched	---	---	---	---	---
		September	1.0	2.0	Perched	---	---	---	---	---
		October	0.5	2.0	Perched	---	---	---	---	---
		November	0.5	2.0	Perched	---	---	---	---	---
		December	1.0	2.0	Perched	---	---	---	---	---
494:										
Gauld-----------	B/D									
		January	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		February	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		March	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		April	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		May	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		June	0.5	> 6.5	Apparent	---	---	---	---	---
		July	1.5	> 6.5	Apparent	---	---	---	---	---
		August	2.0	> 6.5	Apparent	---	---	---	---	---
		September	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		October	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		November	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
		December	0.0	> 6.5	Apparent	0.0-1.0	Long	---	---	---
W.										
Water										

Table 22.—Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
13:									
Tawas	---	> 80	---	---	4-15	25-30	High	High	Moderate.
Lupton	---	> 80	---	---	6-18	50-55	High	High	Low.
14:									
Dawson	---	> 80	---	---	---	30-36	High	High	High.
Loxley	---	> 80	---	---	6-18	50-55	High	High	High.
15A:									
Croswell	---	> 80	---	---	---	---	Low	Low	Moderate.
Au Gres	---	> 80	---	---	---	---	Moderate	Low	Moderate.
16B, 16E:									
Graycalm	---	> 80	---	---	---	---	Low	Low	Moderate.
17A:									
Croswell	---	> 80	---	---	---	---	Low	Low	Moderate.
18A:									
Au Gres	---	> 80	---	---	---	---	Moderate	Low	Moderate.
19:									
Leafriver	---	> 80	---	---	---	5-10	High	High	High.
20B, 20D, 20F:									
Graycalm	---	> 80	---	---	---	---	Low	Low	Moderate.
Grayling	---	> 80	---	---	---	---	Low	Low	Moderate.
21B, 21D, 21F:									
Graycalm	---	> 80	---	---	---	---	Low	Low	Moderate.
Klacking	---	> 80	---	---	---	---	Low	Low	Moderate.

Table 22.—Soil Features—Continued

Map symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Subsidence: Initial	Subsidence: Total	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		In	In		In	In			
22B:									
Montcalm-----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
23:									
Ausable------------	---	> 80	---	---	---	---	Moderate----	High--------	Low.
Bowstring----------	---	> 80	---	---		20-30	High--------	High--------	Low.
24A:									
Kinross------------	---	> 80	---	---	---	---	High--------	High--------	Moderate.
Au Gres------------	---	> 80	---	---	---	---	Moderate----	Low---------	Moderate.
26B:									
Cublake------------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
28B:									
East Lake----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
32B:									
Kellogg------------	---	> 80	---	---	---	---	Low---------	High--------	Low.
35:									
Kinross------------	---	> 80	---	---	---	---	High--------	High--------	Moderate.
47D:									
Graycalm-----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
48B, 48D, 48E:									
Rubicon------------	---	> 80	---	---	---	---	Low---------	Low---------	High.
Graycalm-----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
49B, 49B3, 49C, 49D, 49E:									
Kalkaska----------	---	> 80	---	---	---	---	Low---------	Low---------	High.

Table 22.—Soil Features—Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
50B:									
Au Gres	---	> 80	---	---	---	---	Moderate	Low	Moderate.
Kinross	---	> 80	---	---	---	---	High	High	Moderate.
Croswell	---	> 80	---	---	---	---	Low	Low	Moderate.
51:									
Tawas	---	> 80	---	---	4-15	25-30	High	High	Moderate.
Leafriver	---	> 80	---	---	---	5-10	High	High	High.
53B, 53C:									
Negwegon	---	> 80	---	---	---	---	Moderate	High	Low.
54A:									
Algonquin	---	> 80	---	---	---	---	High	High	Low.
58A:									
Wakeley	---	> 80	---	---	---	---	Moderate	High	Moderate.
Allendale	---	> 80	---	---	---	---	Moderate	High	Moderate.
75B, 75D, 75E:									
Rubicon	---	> 80	---	---	---	---	Low	Low	High.
78.									
Pits, borrow									
81B, 81D, 81E, 81F:									
Grayling	---	> 80	---	---	---	---	Low	Low	Moderate.
83B, 83F:									
Udipsamments	---	> 80	---	---	---	---	Low	Low	Moderate.
86:									
Histosols	---	> 80	---	---	---	---	High	---	---
Aquents	---	> 80	---	---	---	---	High	---	---

Table 22.—Soil Features—Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
87:									
Ausable	---	> 80	---	---	---	---	Moderate	High	Low.
99:									
Roscommon	---	> 80	---	---	---	5-10	High	High	Low.
131E:									
Rubicon	---	> 80	---	---	---	---	Low	Low	High.
Menominee	---	> 80	---	---	---	---	Low	Low	Moderate.
147B, 147C, 147D, 147E:									
Lindquist	---	> 80	---	---	---	---	Low	Low	Moderate.
159A:									
Finch	Ortstein	10-16	0-3	---	---	---	Low	High	Moderate.
174A:									
Au Gres	---	> 80	---	---	---	---	Moderate	Low	Moderate.
Roscommon	---	> 80	---	---	---	5-10	High	High	Low.
197A:									
Gladwin	---	> 80	---	---	---	---	Moderate	Low	Low.
338B, 338C, 338D, 338E:									
Islandlake	---	> 80	---	---	---	---	Low	Low	High.
360:									
Wakeley	---	> 80	---	---	---	---	Moderate	High	Moderate.
366B, 366C, 366D, 366E:									
Islandlake	---	> 80	---	---	---	---	Low	Low	High.
Blue Lake	---	> 80	---	---	---	---	Low	Low	Moderate.

Table 22.—Soil Features—Continued

Map symbol and soil name	Restrictive layer: Kind	Depth to top	Thickness	Hardness	Subsidence: Initial	Total	Potential for frost action	Risk of corrosion: Uncoated steel	Concrete
		In	In		In	In			
371:									
Springport	---	> 80	---	---	---	---	High	High	Low.
380.									
Access denied									
402B, 402C:									
Islandlake	---	> 80	---	---	---	---	Low	Low	High.
406A:									
Winterfield	---	> 80	---	---	---	---	Moderate	Low	Low.
412A:									
Ingalls	---	> 80	---	---	---	---	Moderate	Moderate	Moderate.
Burleigh	---	> 80	---	---	---	---	Moderate	High	Low.
454B, 454C, 454D, 454E:									
Springlake	---	> 80	---	---	---	---	Low	Low	Moderate.
457B, 457C, 457D, 457E:									
Islandlake	---	> 80	---	---	---	---	Low	Low	High.
Southwells	---	> 80	---	---	---	---	Low	Low	High.
458D:									
Islandlake	---	> 80	---	---	---	---	Low	Low	High.
Menominee	---	> 80	---	---	---	---	Low	Low	Moderate.
459B, 459D, 459E:									
Rubicon	---	> 80	---	---	---	---	Low	Low	High.
460B, 460C, 460D, 460E, 460F:									
Rubicon	---	> 80	---	---	---	---	Low	Low	High.
Mancelona	---	> 80	---	---	---	---	Low	Low	Low.

Table 22.—Soil Features—Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
461A:									
Allendale----------	---	> 80	---	---	---	---	Moderate----	High--------	Moderate.
Springport---------	---	> 80	---	---	---	---	High--------	High--------	Low.
462A:									
Allendale----------	---	> 80	---	---	---	---	Moderate----	High--------	Moderate.
Algonquin----------	---	> 80	---	---	---	---	High--------	High--------	Low.
466B:									
Halfaday-----------	---	> 80	---	---	---	---	Low---------	Low---------	High.
467B, 467C:									
Morganlake---------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
Woodman------------	---	> 80	---	---	---	---	Moderate----	High--------	Low.
Blue Lake----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
468F:									
Southwells---------	---	> 80	---	---	---	---	Low---------	Low---------	High.
Mancelona----------	---	> 80	---	---	---	---	Low---------	Low---------	Low.
Dighton------------	---	> 80	---	---	---	---	Moderate----	High--------	Low.
469B:									
Hodenpyl-----------	---	> 80	---	---	---	---	Moderate----	Low---------	Moderate.
Montcalm-----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
471B:									
Mancelona----------	---	> 80	---	---	---	---	Low---------	Low---------	Low.
Blue Lake----------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.
472B:									
Morganlake---------	---	> 80	---	---	---	---	Low---------	Low---------	Moderate.

Table 22.—Soil Features—Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
488A:									
Allendale----------	---	> 80	---	---	---	---	Moderate----	High--------	Moderate.
494:									
Gauld--------------	---	> 80	---	---	---	---	High--------	High--------	Low.
W.									
Water									

Table 23.—Classification of the Soils

Soil name	Family or higher taxonomic class
Algonquin	Fine, mixed, semiactive, frigid Aquic Hapludalfs
Allendale	Sandy over clayey, mixed, semiactive, frigid Alfic Epiaquods
Aquents	Aquents
Au Gres	Sandy, mixed, frigid Typic Endoaquods
Ausable	Sandy, mixed, frigid Histic Humaquepts
Blue Lake	Sandy, mixed, frigid Lamellic Haplorthods
Bowstring	Euic, frigid Fluvaquentic Haplosaprists
Burleigh	Sandy over loamy, mixed, nonacid, active, frigid Mollic Endoaquents
Croswell	Sandy, mixed, frigid Oxyaquic Haplorthods
Cublake	Sandy, mixed, frigid Oxyaquic Haplorthods
Dawson	Sandy or sandy-skeletal, mixed, dysic, frigid Terric Haplosaprists
Dighton	Clayey over sandy or sandy-skeletal, mixed, semiactive, frigid Haplic Glossudalfs
East Lake	Sandy, mixed, frigid Entic Haplorthods
Finch	Sandy, mixed, frigid, ortstein Typic Duraquods
Gauld	Coarse-loamy, mixed, semiactive, frigid Typic Endoaquolls
Gladwin	Sandy, mixed, frigid Alfic Haplaquods
Graycalm	Mixed, frigid Lamellic Udipsamments
Grayling	Mixed, frigid Typic Udipsamments
Halfaday	Sandy, mixed, frigid Oxyaquic Haplorthods
Histosols	Histosols
Hodenpyl	Coarse-loamy, mixed, active, frigid Haplic Glossudalfs
Ingalls	Sandy over loamy, mixed, active, frigid Typic Endoaquods
Islandlake	Sandy, mixed, frigid Lamellic Haplorthods
Kalkaska	Sandy, mixed, frigid Typic Haplorthods
Kellogg	Sandy over clayey, mixed, active, frigid Alfic Oxyaquic Haplorthods
Kinross	Sandy, mixed, frigid Typic Endoaquods
Klacking	Loamy, mixed, semiactive, frigid Arenic Glossudalfs
Leafriver	Sandy, mixed, frigid Histic Humaquepts
Lindquist	Sandy, mixed, frigid Lamellic Haplorthods
Loxley	Dysic, frigid Typic Haplosaprists
Lupton	Euic, frigid Typic Haplosaprists
Mancelona	Sandy, mixed, frigid Alfic Haplorthods
Menominee	Sandy over loamy, mixed, active, frigid Alfic Haplorthods
Montcalm	Coarse-loamy, mixed, semiactive, frigid Alfic Haplorthods
Morganlake	Sandy over loamy, mixed, active, frigid Alfic Oxyaquic Haplorthods
Negwegon	Fine, mixed, semiactive, frigid Oxyaquic Glossudalfs
Roscommon	Mixed, frigid Mollic Psammaquents
Rubicon	Sandy, mixed, frigid Entic Haplorthods
Southwells	Sandy, mixed, frigid Alfic Haplorthods
Springlake	Sandy, mixed, frigid Typic Haplorthods
Springport	Fine, mixed, calcareous, semiactive, frigid Typic Epiaquolls
Tawas	Sandy or sandy-skeletal, mixed, euic, frigid Terric Haplosaprists
Udipsamments	Udipsamments
Wakeley	Sandy over clayey, mixed, nonacid, semiactive, frigid Aeric Epiaquents
Winterfield	Mixed, frigid Aquic Udipsamments
Woodman	Fine-loamy, mixed, active, frigid Oxyaquic Glossudalfs

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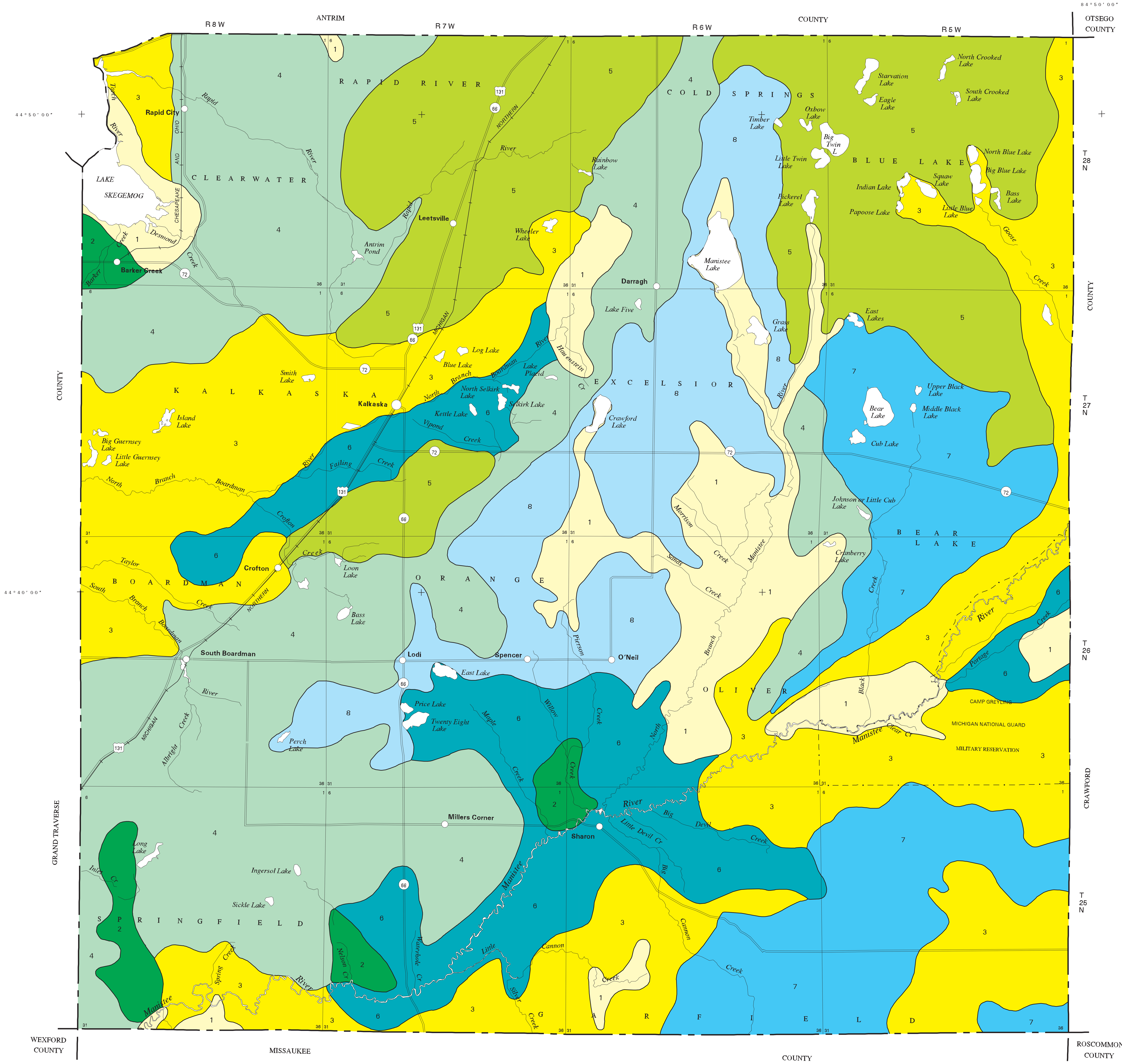


LEGEND

1	LUPTON-TAWAS-ROSCOMMON ASSOCIATION: Nearly level, very poorly drained, mucky soils on moraines, outwash plains, and lake plains.
2	ALGONQUIN-ALLENDALE-NEGWEGON ASSOCIATION: Nearly level to moderately sloping, somewhat poorly drained and moderately well drained, sandy and loamy soils on lake plains.
3	RUBICON-GRAYLING-CROSWELL ASSOCIATION: Nearly level to strongly sloping, excessively drained and moderately well drained, sandy soils on outwash plains.
4	ISLANDLAKE-BLUELAKE-MORGANLAKE, SANDY SUBSTRATUM ASSOCIATION: Nearly level to steep, somewhat excessively drained to well drained, sandy soils on moraines.
5	KALKASKA-SPRINGLAKE-SOUTHWELLS ASSOCIATION: Nearly level to very steep, somewhat excessively drained and well drained, sandy soils on moraines and outwash plains.
6	CROSWELL-AU GRES-LEAFRIVER ASSOCIATION: Level to undulating, moderately well drained, somewhat poorly drained, and very poorly drained, sandy and mucky soils on outwash plains and lake plains.
7	GRAYCALM-KLACKING-RUBICON ASSOCIATION: Nearly level to very steep, excessively drained to well drained, sandy soils on moraines and outwash plains.
8	ISLANDLAKE ASSOCIATION: Nearly level to moderately sloping, somewhat excessively drained, sandy soils on outwash plains.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURE EXPERIMENT STATION
MICHIGAN STATE UNIVERSITY EXTENSION
MICHIGAN TECHNOLOGICAL UNIVERSITY

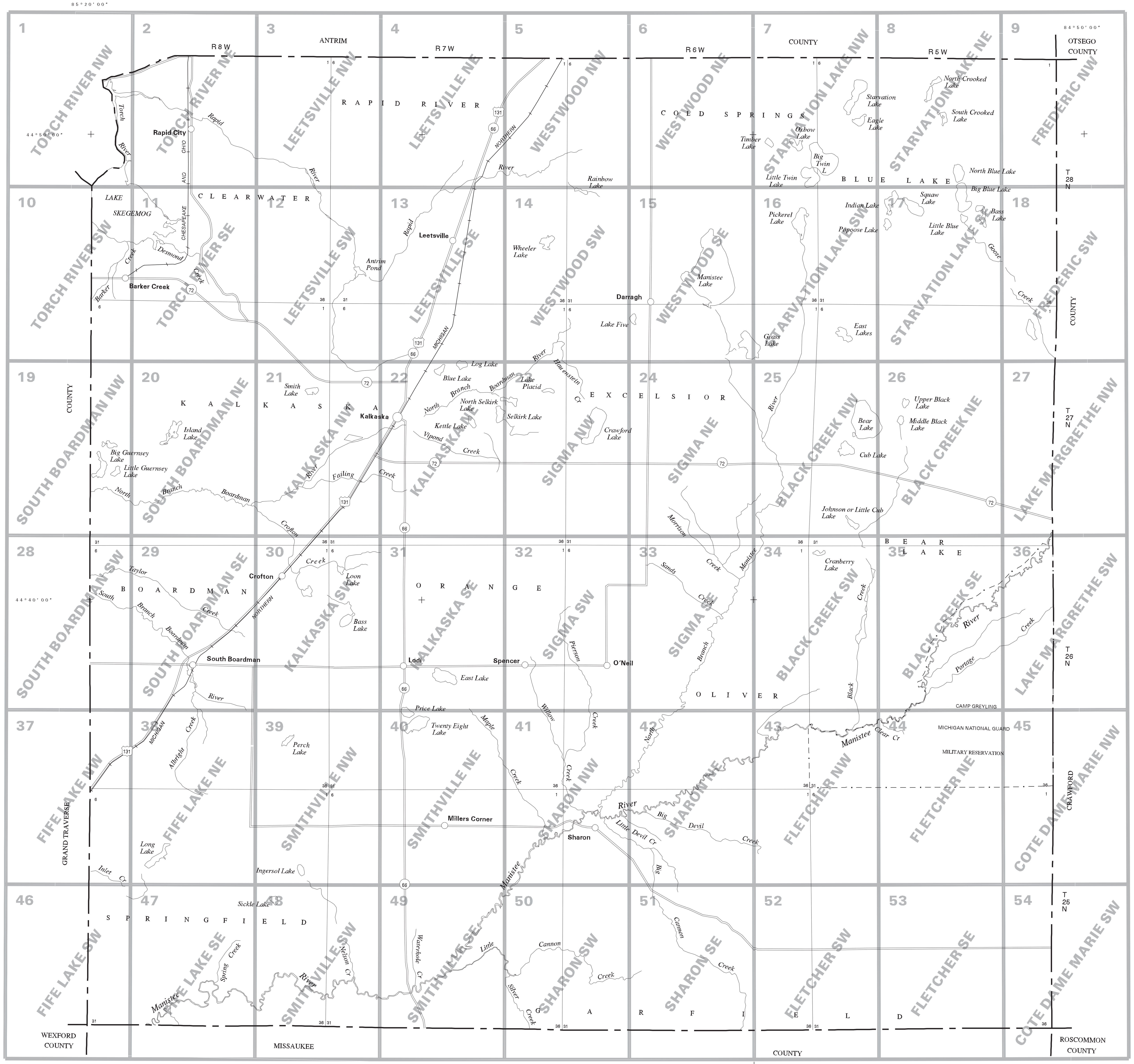
GENERAL SOIL MAP
KALKASKA COUNTY, MICHIGAN

1 0 1 2 3
MILES

1 0 1 2 3 4 5 6
KILOMETERS

SCALE = 1:100000

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
KALKASKA COUNTY, MICHIGAN

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

MILES

KILOMETERS

SCALE = 1:100000

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
13	Tawas-Lupton mucks
14	Dawson-Loxley peats
15A	Croswell-Au Gres sands, 0 to 3 percent slopes
16B	Graycalm sand, 0 to 6 percent slopes
16E	Graycalm sand, 18 to 35 percent slopes
17A	Croswell sand, 0 to 3 percent slopes
18A	Au Gres sand, 0 to 3 percent slopes
19	Leafriver muck
20B	Graycalm-Grayling sands, 0 to 6 percent slopes
20D	Graycalm-Grayling sands, 6 to 18 percent slopes
20F	Graycalm-Grayling sands, 18 to 45 percent slopes
21B	Graycalm-Klacking complex, 0 to 6 percent slopes
21D	Graycalm-Klacking complex, 6 to 18 percent slopes
21F	Graycalm-Klacking complex, 18 to 45 percent slopes
22B	Montcalm loamy sand, 0 to 6 percent slopes
23	Ausable-Bowstring mucks, frequently flooded
24A	Kinross-Au Gres complex, 0 to 3 percent slopes
26B	Cublake sand, 0 to 6 percent slopes
28B	East Lake sand, 0 to 6 percent slopes
32B	Kellogg sand, 0 to 6 percent slopes
35	Kinross muck
47D	Graycalm sand, 6 to 18 percent slopes
48B	Rubicon-Graycalm sands, 0 to 6 percent slopes
48D	Rubicon-Graycalm sands, 6 to 18 percent slopes
48E	Rubicon-Graycalm sands, 18 to 35 percent slopes
49B	Kalkaska sand, 0 to 6 percent slopes
49B3	Kalkaska sand, 0 to 6 percent slopes, severely flooded
49C	Kalkaska sand, 6 to 12 percent slopes
49D	Kalkaska sand, 12 to 18 percent slopes
49E	Kalkaska sand, 18 to 35 percent slopes
50B	Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes
51	Tawas-Leafriver mucks
53B	Negwegon silt loam, 2 to 6 percent slopes
53C	Negwegon silt loam, 6 to 12 percent slopes
54A	Algonquin silt loam, 0 to 3 percent slopes
58A	Wakeley-Allendale complex, 0 to 3 percent slopes
75B	Rubicon sand, 0 to 6 percent slopes
75D	Rubicon sand, 6 to 18 percent slopes
75E	Rubicon sand, 18 to 35 percent slopes
78	Pits, borrow
81B	Grayling sand, 0 to 6 percent slopes
81D	Grayling sand, 6 to 18 percent slopes
81E	Grayling sand, 18 to 35 percent slopes
81F	Grayling sand, 18 to 45 percent slopes
83B	Udipsamments, nearly level and undulating
83F	Udipsamments, nearly level to very steep
86	Histosols and Aquents, ponded
87	Ausable muck, frequently flooded
99	Roscommon mucky sand
131E	Rubicon-Menominee sands, 18 to 35 percent slopes
147B	Lindquist sand, 0 to 6 percent slopes
147C	Lindquist sand, 6 to 12 percent slopes
147D	Lindquist sand, 12 to 18 percent slopes
147E	Lindquist sand, 18 to 35 percent slopes
159A	Finch sand, 0 to 3 percent slopes
174A	Au Gres-Roscommon complex, 0 to 3 percent slopes
197A	Gladwin loamy sand, 0 to 3 percent slopes
338B	Islandlake sand, 0 to 6 percent slopes
338C	Islandlake sand, 6 to 12 percent slopes
338D	Islandlake sand, 12 to 18 percent slopes
338E	Islandlake sand, 18 to 35 percent slopes
360	Wakeley muck
366B	Islandlake-Blue Lake complex, 0 to 6 percent slopes
366C	Islandlake-Blue Lake complex, 6 to 12 percent slopes
366D	Islandlake-Blue Lake complex, 12 to 18 percent slopes
366E	Islandlake-Blue Lake complex, 18 to 35 percent slopes
371	Springport silt loam
380	Access denied
402B	Islandlake loamy sand, 0 to 6 percent slopes
402C	Islandlake loamy sand, 6 to 12 percent slopes
406A	Winterfield loamy sand, 0 to 2 percent slopes, rarely flooded
412A	Ingalls-Burleigh loamy sands, 0 to 3 percent slopes
454B	Springlake sand, 0 to 6 percent slopes
454C	Springlake sand, 6 to 12 percent slopes
454D	Springlake sand, 12 to 18 percent slopes
454E	Springlake sand, 18 to 35 percent slopes
457B	Islandlake-Southwells complex, 0 to 6 percent slopes
457C	Islandlake-Southwells complex, 6 to 12 percent slopes
457D	Islandlake-Southwells complex, 12 to 18 percent slopes
457E	Islandlake-Southwells complex, 18 to 35 percent slopes
458D	Islandlake-Menominee sands, 12 to 18 percent slopes
459B	Rubicon sand, calcareous substratum, 0 to 6 percent slopes
459D	Rubicon sand, calcareous substratum, 6 to 18 percent slopes
459E	Rubicon sand, calcareous substratum, 18 to 35 percent slopes
460B	Rubicon, calcareous substratum-Mancelona sands, 0 to 6 percent slopes
460C	Rubicon, calcareous substratum-Mancelona sands, 6 to 12 percent slopes
460D	Rubicon, calcareous substratum-Mancelona sands, 12 to 18 percent slopes
460E	Rubicon, calcareous substratum-Mancelona sands, 18 to 35 percent slopes
460F	Rubicon, calcareous substratum-Mancelona sands, 35 to 55 percent slopes
461A	Allendale-Springport complex, 0 to 3 percent slopes
462A	Allendale-Algonquin complex, 0 to 3 percent slopes
466B	Halfaday loamy sand, 0 to 4 percent slopes
467B	Morganlake, sandy substratum-Woodman-Blue Lake complex, 1 to 6 percent slopes
467C	Morganlake, sandy substratum-Woodman-Blue Lake complex, 6 to 12 percent slopes
468F	Southwells-Mancelona-Dighton complex, 8 to 50 percent slopes, dissected
469B	Hodenpyl-Montcalm complex, 0 to 6 percent slopes
471B	Mancelona-Blue Lake complex, 0 to 6 percent slopes
472B	Morganlake loamy sand, sandy substratum, 0 to 6 percent slopes
488A	Allendale sand, 0 to 3 percent slopes
494	Gauld fine sandy loam
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Davis Airstrip

Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 173
- Federal — 287
- State — 52
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small (Named where applicable) — water

PITS — w

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial water

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 33E 52D

ESCARPMENTS

- Other than bedrock (points down slope)

SHORT STEEP SLOPE

DEPRESSION, closed

MISCELLANEOUS

- Clay spot
- Gravelly spot
- Sandy spot
- Severely eroded spot
- Stony spot
- Loam at depth
- Bog
- Mineral spot
- Cut and fill spot
- Dump
- Gravel strata
- Loamy spot
- Organic spot
- Marl

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QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 ELK RAPIDS SE
2 ALDEN SW
3 ALDEN SE
4 WILLIAMSBURG NE
5 TORCH RIVER NE (SHEET 2)
6 WILLIAMSBURG SE
7 TORCH RIVER SW (SHEET 10)
8 TORCH RIVER SE (SHEET 11)

INDEX TO ADJOINING 3.75 MAPS

TORCH RIVER NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 1 OF 54

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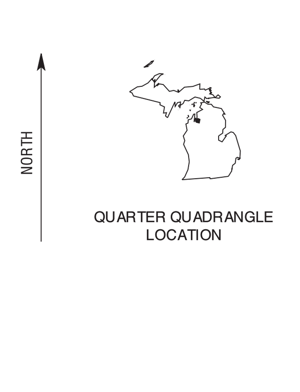
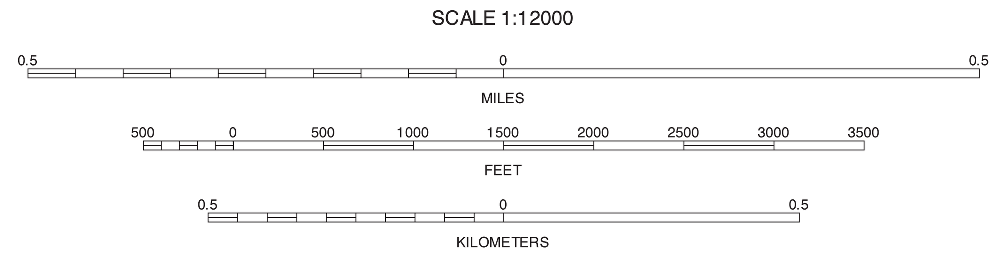


QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 ALDEN SW
2 ALDEN SE
3 BELLAIRE SW
4 TORCH RIVER NW (SHEET 1)
5 LEETSVILLE NW (SHEET 3)
6 TORCH RIVER SW (SHEET 10)
7 TORCH RIVER SE (SHEET 11)
8 LEETSVILLE SW (SHEET 12)

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3.75 MINUTE SERIES
SHEET NUMBER 2 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
LEETSVILLE NW QUADRANGLE
SHEET NUMBER 3 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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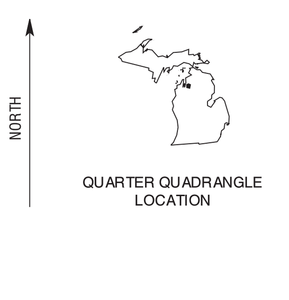

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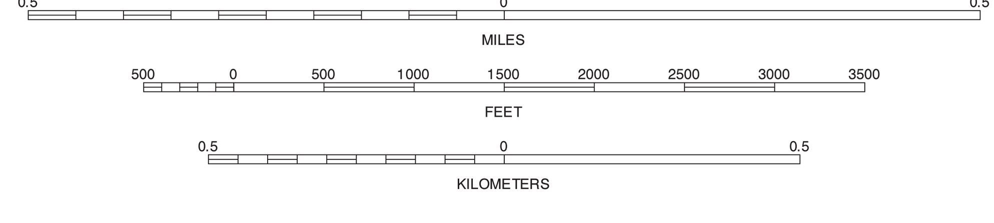

1	2	3	
4		5	
6	7	8	

1 ALDEN SE
2 BELLAIRE SW
3 BELLAIRE SE
4 TORCH RIVER NE (SHEET 2)
5 LEETSVILLE NE (SHEET 4)
6 TORCH RIVER SE (SHEET 11)
7 LEETSVILLE SW (SHEET 12)
8 LEETSVILLE SE (SHEET 13)

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3.75 MINUTE SERIES
SHEET NUMBER 3 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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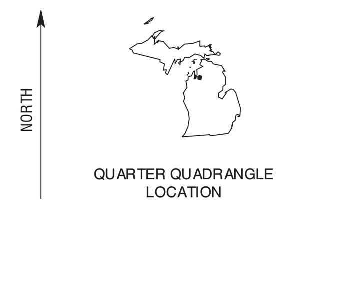

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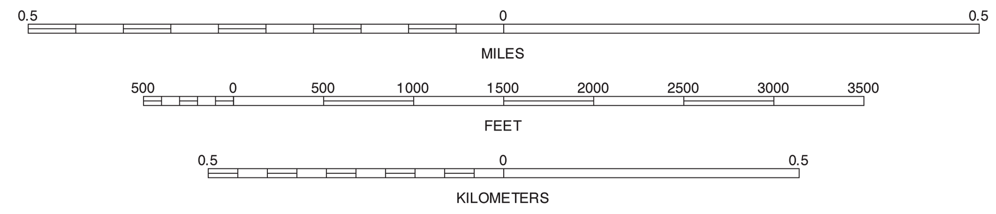

1	2	3
4		5
6	7	8

1 BELLAIRE SW
2 BELLAIRE SE
3 MENCELONA SW
4 LEETSVILLE NW (SHEET 3)
5 WESTWOOD NW (SHEET 5)
6 LEETSVILLE SW (SHEET 12)
7 LEETSVILLE SE (SHEET 13)
8 WESTWOOD SW (SHEET 14)

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LEETSVILLE NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 4 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
WESTWOOD NW QUADRANGLE
SHEET NUMBER 5 OF 54

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5
MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500
FEET

0.5 — 0 — 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 BELLAIRE SE
2 MANCELONA SW
3 MANCELONA SE
4 LEETSVILLE NE (SHEET 4)
5 WESTWOOD NE (SHEET 6)
6 LEETSVILLE SE (SHEET 13)
7 WESTWOOD SW (SHEET 14)
8 WESTWOOD SE (SHEET 15)

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UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
WESTWOOD NE QUADRANGLE
SHEET NUMBER 6 OF 54

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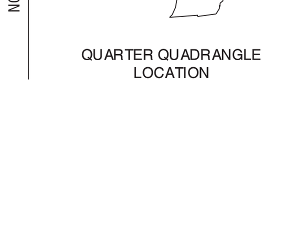

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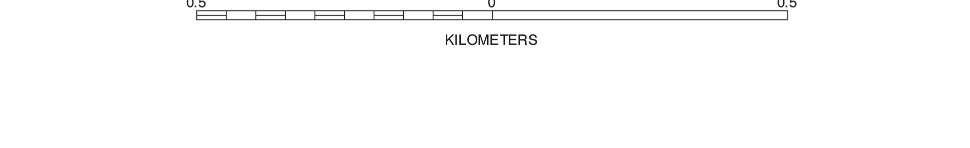

1	2	3
4		5
6	7	8

1 MANCELONA SW
2 MANCELONA SE
3 ALBA SW
4 WESTWOOD NW (SHEET 5)
5 STARVATION LAKE NW (SHEET 7)
6 WESTWOOD SW (SHEET 14)
7 WESTWOOD SE (SHEET 15)
8 STARVATION LAKE SW (SHEET 16)

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UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
STARVATION LAKE NW QUADRANGLE
SHEET NUMBER 7 OF 54

SCALE 1:12000

MILES

FEET

KILOMETERS

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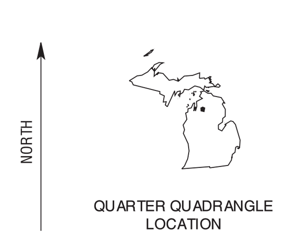

QUARTER QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 MANCELONA SE
2 ALBA SW
3 ALBA SE
4 WESTWOOD NE (SHEET 6)
5 STARVATION LAKE NE (SHEET 8)
6 WESTWOOD SE (SHEET 15)
7 STARVATION LAKE SW (SHEET 16)
8 STARVATION LAKE SE (SHEET 17)

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UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
STARVATION LAKE NE QUADRANGLE
SHEET NUMBER 8 OF 54

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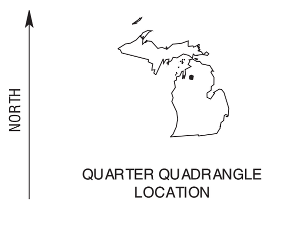

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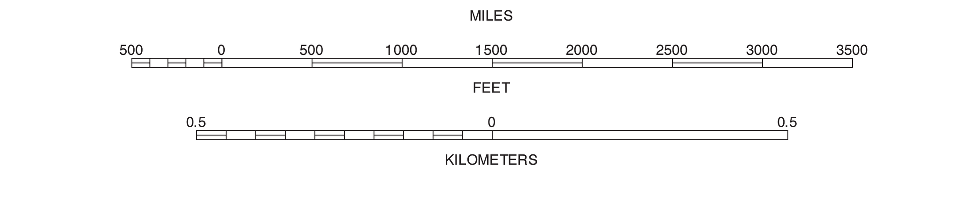

1	2	3
4		5
6	7	8

1 ALBA SW
2 ALBA SE
3 LAKE ARROWHEAD SW
4 STARVATION LAKE NW (SHEET 7)
5 FREDERIC NW (SHEET 9)
6 STARVATION LAKE SW (SHEET 16)
7 STARVATION LAKE SE (SHEET 17)
8 FREDERIC SW (SHEET 18)

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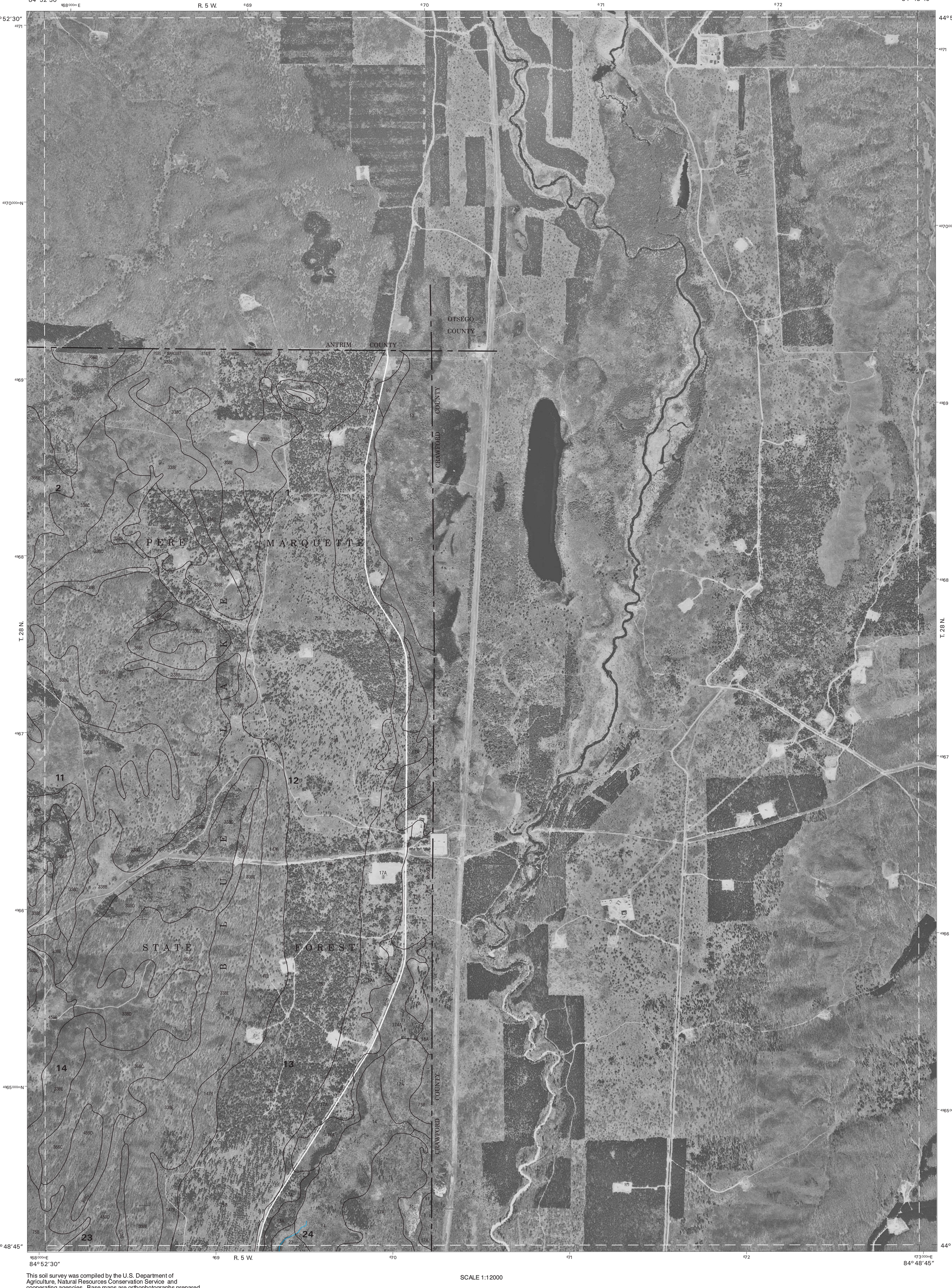
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
FREDERIC NW QUADRANGLE
SHEET NUMBER 9 OF 54



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5
MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500
FEET

0.5 — 0 — 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 ALBA SE
2 LAKE ARROWHEAD SW
3 LAKE ARROWHEAD SE
4 STARVATION LAKE NE (SHEET 8)
5 FREDERIC NE
6 STARVATION LAKE SE (SHEET 17)
7 FREDERIC SW (SHEET 18)
8 FREDERIC SE

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FREDERIC NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 9 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
TORCH RIVER SW QUADRANGLE
SHEET NUMBER 10 OF 54

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 WILLIAMSBURG NE
2 TORCH RIVER NW (SHEET 1)
3 TORCH RIVER NE (SHEET 2)
4 WILLIAMSBURG SE
5 TORCH RIVER SE (SHEET 11)
6 JACKS LANDING NE
7 SOUTH BOARDMAN NW (SHEET 19)
8 SOUTH BOARDMAN NE (SHEET 20)

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TORCH RIVER SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 10 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 TORCH RIVER NW (SHEET 1)
2 TORCH RIVER NE (SHEET 2)
3 LEETSVILLE NW (SHEET 3)
4 TORCH RIVER SW (SHEET 10)
5 LEETSVILLE SW (SHEET 12)
6 SOUTH BOARDMAN NW (SHEET 19)
7 SOUTH BOARDMAN NE (SHEET 20)
8 KALKASKA NW (SHEET 21)

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TORCH RIVER SE, MICHIGAN

3.75 MINUTE SERIES

SHEET NUMBER 11 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
LEETSVILLE SW QUADRANGLE
SHEET NUMBER 12 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 TORCH RIVER NE (SHEET 2)
2 LEETSVILLE NW (SHEET 3)
3 LEETSVILLE NE (SHEET 4)
4 TORCH RIVER SE (SHEET 11)
5 LEETSVILLE SE (SHEET 13)
6 SOUTH BOARDMAN NE (SHEET 20)
7 KALKASKA NW (SHEET 21)
8 KALKASKA NE (SHEET 22)

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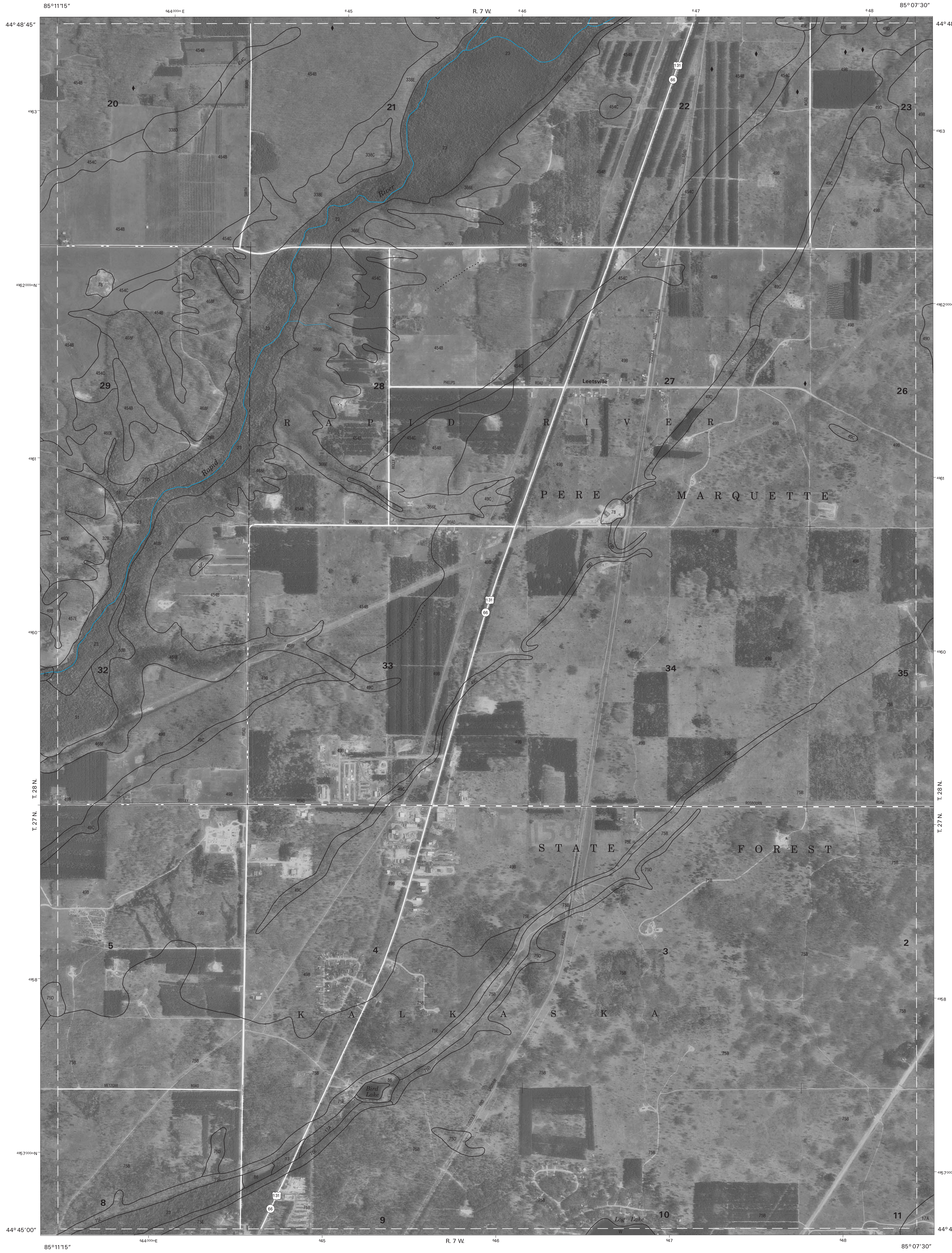
LEETSVILLE SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 12 OF 54



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 LEETSVILLE NW (SHEET 3)
2 LEETSVILLE NE (SHEET 4)
3 WESTWOOD NW (SHEET 5)
4 LEETSVILLE SW (SHEET 12)
5 WESTWOOD SW (SHEET 14)
6 KALKASKA NW (SHEET 21)
7 KALKASKA NE (SHEET 22)
8 SIGMA NW (SHEET 23)

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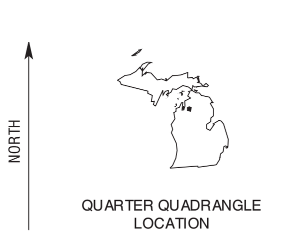
LEETSVILLE SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 13 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
WESTWOOD SW QUADRANGLE
SHEET NUMBER 14 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 LEETSVILLE NE (SHEET 4)
2 WESTWOOD NW (SHEET 5)
3 WESTWOOD NE (SHEET 6)
4 LEETSVILLE SE (SHEET 13)
5 WESTWOOD SE (SHEET 15)
6 KALKASKA NE (SHEET 22)
7 SIGMA NW (SHEET 23)
8 SIGMA NE (SHEET 24)

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WESTWOOD SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 14 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
WESTWOOD SE QUADRANGLE
SHEET NUMBER 15 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 WESTWOOD NW (SHEET 5)
2 WESTWOOD NE (SHEET 6)
3 STARVATION LAKE NW (SHEET 7)
4 WESTWOOD SW (SHEET 14)
5 STARVATION LAKE SW (SHEET 16)
6 SIGMA NW (SHEET 23)
7 SIGMA NE (SHEET 24)
8 BLACK CREEK NW (SHEET 25)

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WESTWOOD SE, MICHIGAN
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SHEET NUMBER 15 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
STARVATION LAKE SW QUADRANGLE
SHEET NUMBER 16 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 WESTWOOD NE (SHEET 6)
2 STARVATION LAKE NW (SHEET 7)
3 STARVATION LAKE NE (SHEET 8)
4 WESTWOOD SE (SHEET 15)
5 STARVATION LAKE SE (SHEET 17)
6 SIGMA NE (SHEET 24)
7 BLACK CREEK NW (SHEET 25)
8 BLACK CREEK NE (SHEET 26)

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SHEET NUMBER 16 OF 54

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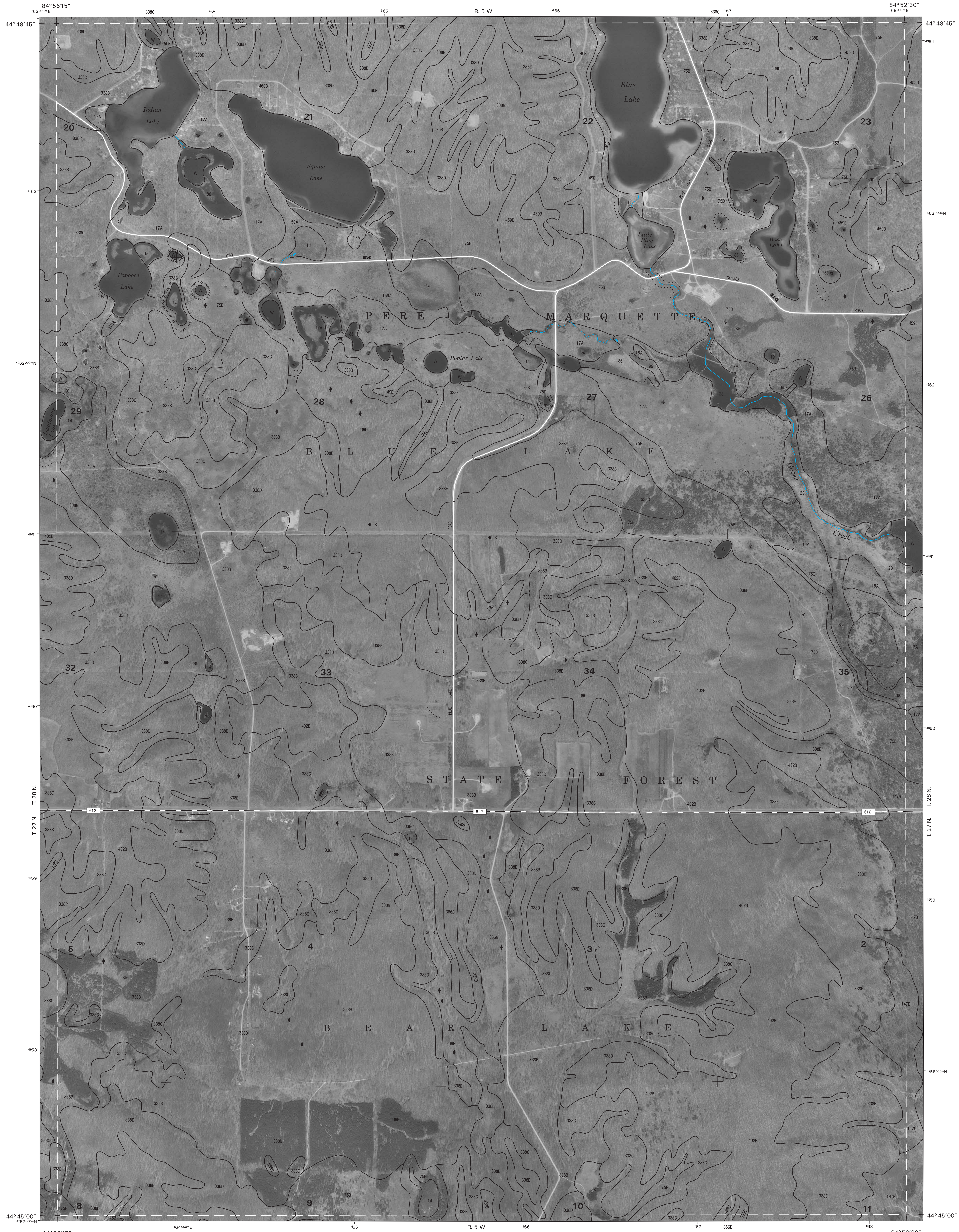
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
STARVATION LAKE SE QUADRANGLE
SHEET NUMBER 17 OF 54



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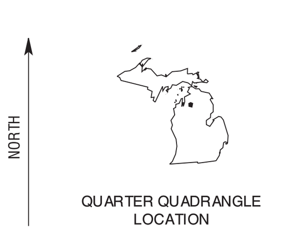

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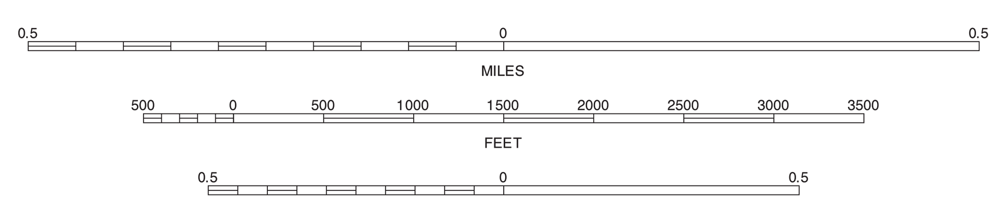

1	2	3
4		5
6	7	8

1 STARVATION LAKE NW (SHEET 7)
2 STARVATION LAKE NE (SHEET 8)
3 FREDERIC NW (SHEET 9)
4 STARVATION LAKE SW (SHEET 16)
5 FREDERIC SW (SHEET 18)
6 BLACK CREEK NW (SHEET 25)
7 BLACK CREEK NE (SHEET 26)
8 LAKE MARGRETHE NW (SHEET 27)

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SHEET NUMBER 17 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
FREDERIC SW QUADRANGLE
SHEET NUMBER 18 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

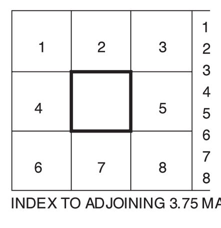
QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS



1 STARVATION LAKE NE (SHEET 8)
2 FREDERIC NW (SHEET 9)
3 FREDERIC NE
4 STARVATION LAKE SE (SHEET 17)
5 FREDERIC SE
6 BLACK CREEK NE (SHEET 26)
7 LAKE MARGRETHE NW (SHEET 27)
8 LAKE MARGRETHE NE

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FREDERIC SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 18 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 WILLIAMSBURG SE
2 TORCH RIVER SW (SHEET 10)
3 TORCH RIVER SE (SHEET 11)
4 JACKS LANDING NE
5 SOUTH BOARDMAN NE (SHEET 20)
6 JACKS LANDING SE
7 SOUTH BOARDMAN SW (SHEET 28)
8 SOUTH BOARDMAN SE (SHEET 29)

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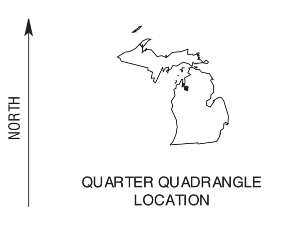
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SOUTH BOARDMAN NE QUADRANGLE
SHEET NUMBER 20 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



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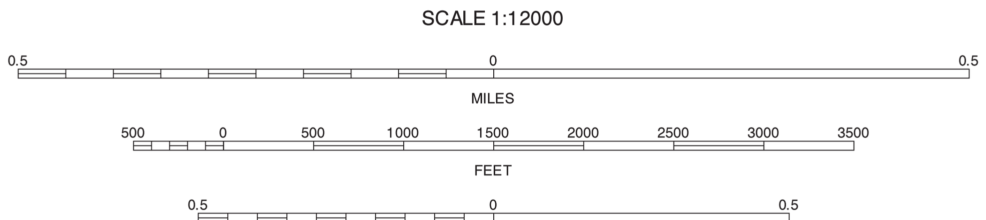

1	2	3
4		5
6	7	8

1 TORCH RIVER SW (SHEET 10)
2 TORCH RIVER SE (SHEET 11)
3 LEETSVILLE SW (SHEET 12)
4 SOUTH BOARDMAN NW (SHEET 19)
5 KALKASKA NW (SHEET 21)
6 SOUTH BOARDMAN SW (SHEET 28)
7 SOUTH BOARDMAN SE (SHEET 29)
8 KALKASKA SW (SHEET 30)

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SOUTH BOARDMAN NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 20 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
KALKASKA NW QUADRANGLE
SHEET NUMBER 21 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 TORCH RIVER SE (SHEET 11)
2 LEETSVILLE SW (SHEET 12)
3 LEETSVILLE SE (SHEET 13)
4 SOUTH BOARDMAN NE (SHEET 20)
5 KALKASKA NE (SHEET 22)
6 SOUTH BOARDMAN SE (SHEET 29)
7 KALKASKA SW (SHEET 30)
8 KALKASKA SE (SHEET 31)

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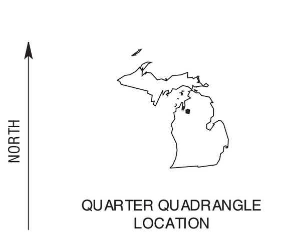
KALKASKA NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 21 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3	
4		5	
6	7	8	

1 LEETSVILLE SW (SHEET 12)
2 LEETSVILLE SE (SHEET 13)
3 WESTWOOD SW (SHEET 14)
4 KALKASKA NW (SHEET 21)
5 SIGMA NW (SHEET 23)
6 KALKASKA SW (SHEET 30)
7 KALKASKA SE (SHEET 31)
8 SIGMA SW (SHEET 32)

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KALKASKA NE, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 22 OF 54

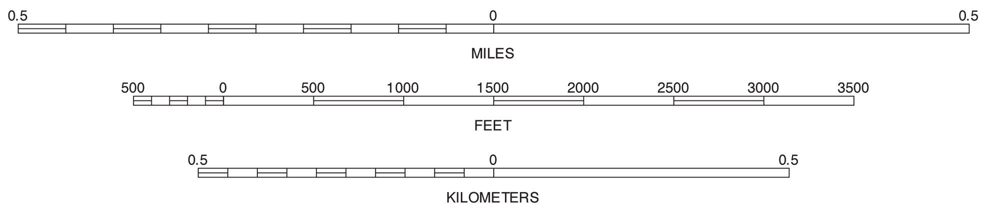
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SIGMA NW QUADRANGLE
SHEET NUMBER 23 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

SCALE 1:12000



1	2	3
4		5
6	7	8

1 LEETSVILLE SE (SHEET 13)
2 WESTWOOD SW (SHEET 14)
3 WESTWOOD SE (SHEET 15)
4 KALKASKA NE (SHEET 22)
5 SIGMA NE (SHEET 24)
6 KALKASKA SE (SHEET 31)
7 SIGMA SW (SHEET 32)
8 SIGMA SE (SHEET 33)

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3.75 MINUTE SERIES
SHEET NUMBER 23 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SIGMA NE QUADRANGLE
SHEET NUMBER 24 OF 54

85° 03′45″ | R. 6 W. | 85° 00′00″

44° 45′00″

44° 41′15″

85° 03′45″ | R. 6 W. | 85° 00′00″

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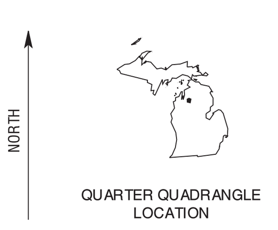
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 | 0 | 0.5

FEET: 500 | 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500

KILOMETERS: 0.5 | 0 | 0.5

1	2	3
4		5
6	7	8

1 WESTWOOD SW (SHEET 14)
2 WESTWOOD SE (SHEET 15)
3 STARVATION LAKE SW (SHEET 16)
4 SIGMA NW (SHEET 23)
5 BLACK CREEK NW (SHEET 25)
6 SIGMA SW (SHEET 32)
7 SIGMA SE (SHEET 33)
8 BLACK CREEK SW (SHEET 34)

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SIGMA NE, MICHIGAN

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UNITED STATES
DEPARTMENT OF AGRICULTURE
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KALKASKA COUNTY, MICHIGAN
BLACK CREEK NW QUADRANGLE
SHEET NUMBER 25 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 WESTWOOD SE (SHEET 15)
2 STARVATION LAKE SW (SHEET 16)
3 STARVATION LAKE SE (SHEET 17)
4 SIGMA NE (SHEET 24)
5 BLACK CREEK NE (SHEET 26)
6 SIGMA SE (SHEET 33)
7 BLACK CREEK SW (SHEET 34)
8 BLACK CREEK SE (SHEET 35)

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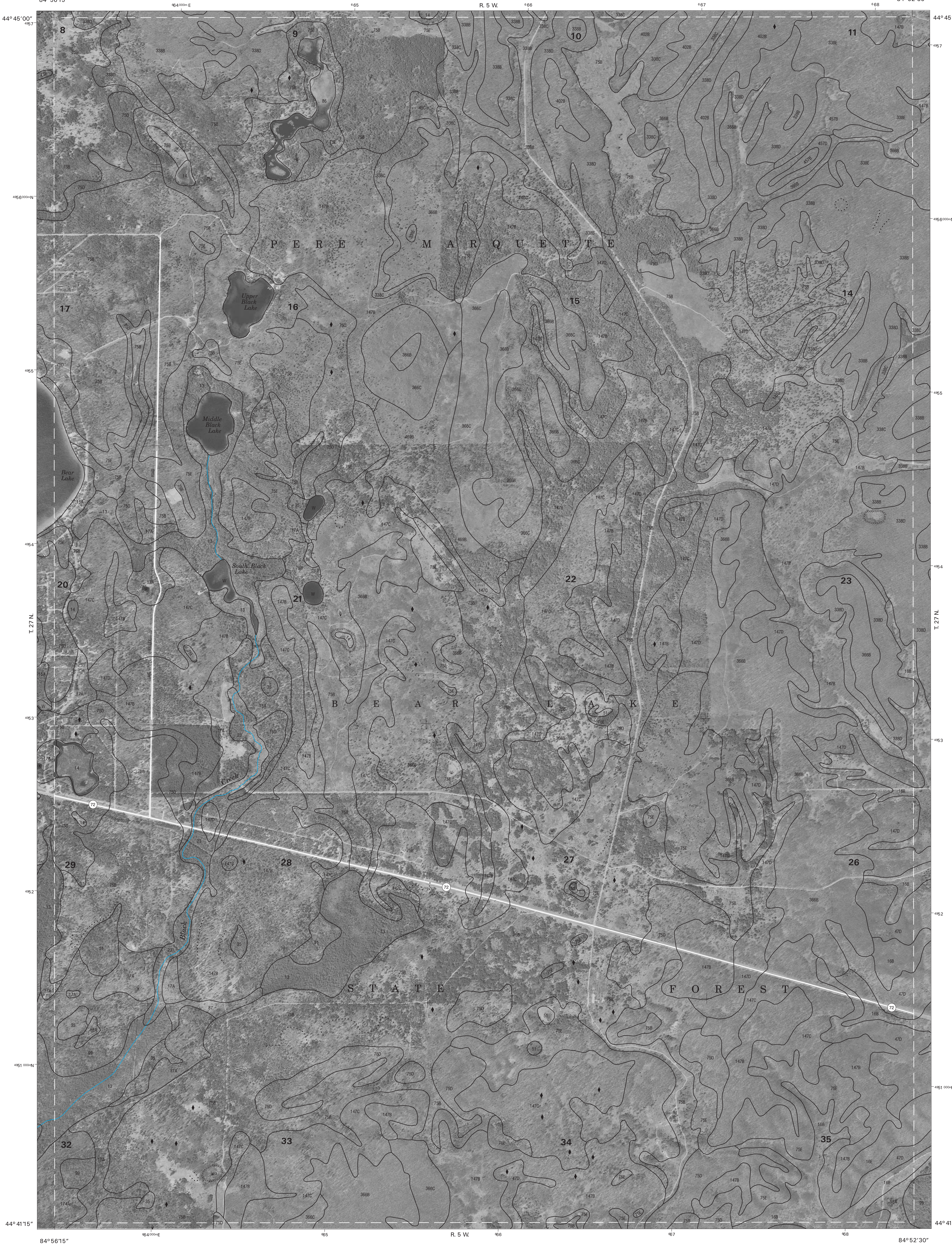
BLACK CREEK NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 25 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
BLACK CREEK NE QUADRANGLE
SHEET NUMBER 26 OF 54



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 STARVATION LAKE SW (SHEET 16)
2 STARVATION LAKE SE (SHEET 17)
3 FREDERIC SW (SHEET 18)
4 BLACK CREEK NW (SHEET 25)
5 LAKE MARGRETHE NW (SHEET 27)
6 BLACK CREEK SW (SHEET 34)
7 BLACK CREEK SE (SHEET 35)
8 LAKE MARGRETHE SW (SHEET 36)

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BLACK CREEK NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 26 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
LAKE MARGRETHE NW QUADRANGLE
SHEET NUMBER 27 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 STARVATION LAKE SE (SHEET 17)
2 FREDERIC SW (SHEET 18)
3 FREDERIC SE
4 BLACK CREEK NE (SHEET 26)
5 LAKE MARGRETHE NE
6 BLACK CREEK SE (SHEET 35)
7 LAKE MARGRETHE SW (SHEET 36)
8 LAKE MARGRETHE SE

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LAKE MARGRETHE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 27 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SOUTH BOARDMAN SW QUADRANGLE
SHEET NUMBER 28 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 JACKS LANDING NE
2 SOUTH BOARDMAN NW (SHEET 19)
3 SOUTH BOARDMAN NE (SHEET 20)
4 JACKS LANDING SE
5 SOUTH BOARDMAN SE (SHEET 29)
6 WALTON NE
7 FIFE LAKE NW (SHEET 37)
8 FIFE LAKE NE (SHEET 38)

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SOUTH BOARDMAN SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 28 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SOUTH BOARDMAN SE QUADRANGLE
SHEET NUMBER 29 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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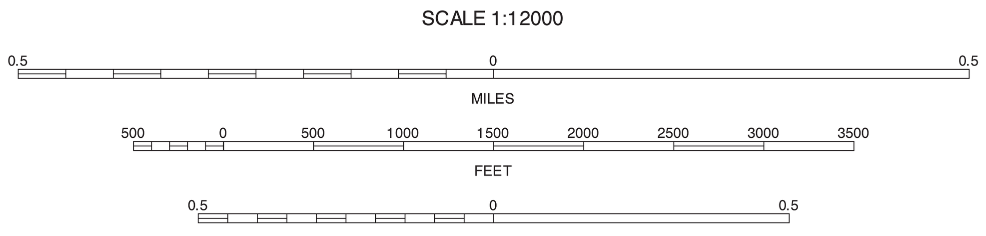
NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 SOUTH BOARDMAN NW (SHEET 19)
2 SOUTH BOARDMAN NE (SHEET 20)
3 KALKASKA NW (SHEET 21)
4 SOUTH BOARDMAN SW (SHEET 28)
5 KALKASKA SW (SHEET 30)
6 FIFE LAKE NW (SHEET 37)
7 FIFE LAKE NE (SHEET 38)
8 SMITHVILLE NW (SHEET 39)

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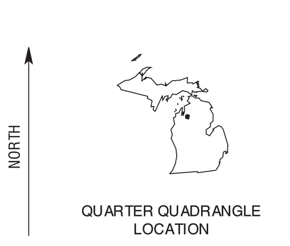
SOUTH BOARDMAN SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 29 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
KALKASKA SW QUADRANGLE
SHEET NUMBER 30 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 SOUTH BOARDMAN NE (SHEET 20)
2 KALKASKA NW (SHEET 21)
3 KALKASKA NE (SHEET 22)
4 SOUTH BOARDMAN SE (SHEET 29)
5 KALKASKA SE (SHEET 31)
6 FIFE LAKE NE (SHEET 38)
7 SMITHVILLE NW (SHEET 39)
8 SMITHVILLE NE (SHEET 40)

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KALKASKA SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 30 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
KALKASKA SE QUADRANGLE
SHEET NUMBER 31 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 KALKASKA NW (SHEET 21)
2 KALKASKA NE (SHEET 22)
3 SIGMA NW (SHEET 23)
4 KALKASKA SW (SHEET 30)
5 SIGMA SW (SHEET 32)
6 SMITHVILLE NW (SHEET 39)
7 SMITHVILLE NE (SHEET 40)
8 SHARON NW (SHEET 41)

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KALKASKA SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 31 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SIGMA SW QUADRANGLE
SHEET NUMBER 32 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 KALKASKA NE (SHEET 22)
2 SIGMA NW (SHEET 23)
3 SIGMA NE (SHEET 24)
4 KALKASKA SE (SHEET 31)
5 SIGMA SE (SHEET 33)
6 SMITHVILLE NE (SHEET 40)
7 SHARON NW (SHEET 41)
8 SHARON NE (SHEET 42)

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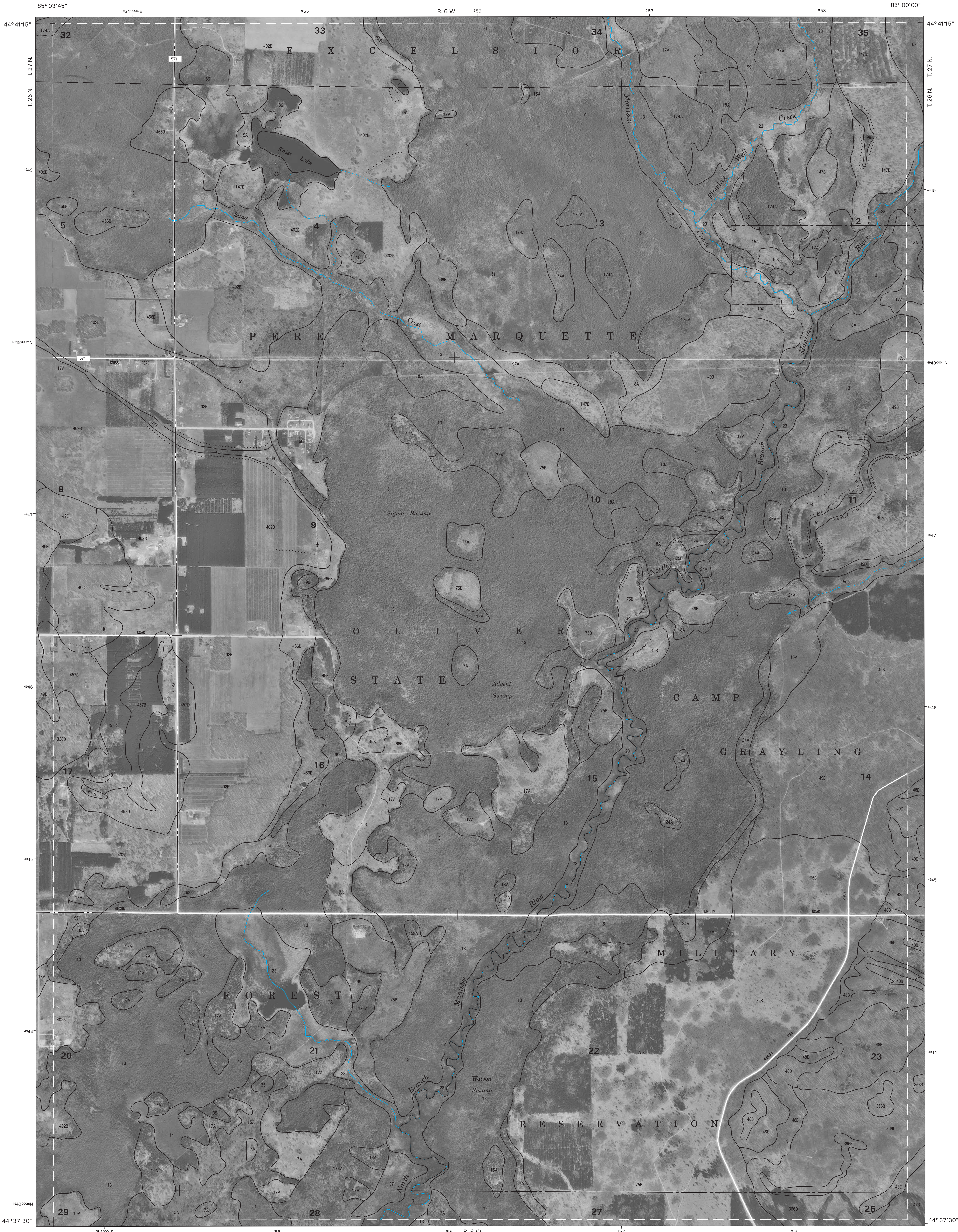
SIGMA SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 32 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SIGMA SE QUADRANGLE
SHEET NUMBER 33 OF 54



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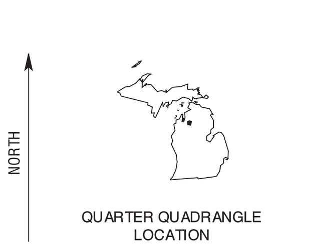
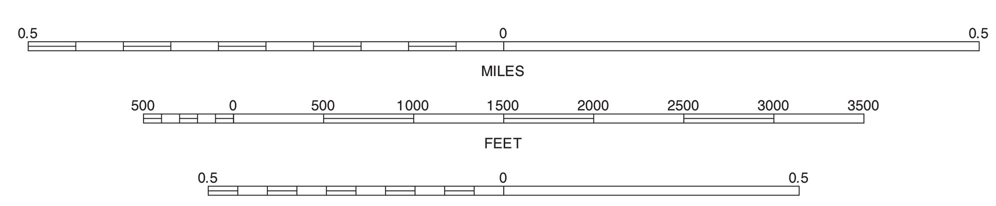


QUARTER QUADRANGLE LOCATION



1	2	3
4		5
6	7	8

1 SIGMA NW (SHEET 23)
2 SIGMA NE (SHEET 24)
3 BLACK CREEK NW (SHEET 25)
4 SIGMA SW (SHEET 32)
5 BLACK CREEK SW (SHEET 34)
6 SHARON NW (SHEET 41)
7 SHARON NE (SHEET 42)
8 FLETCHER NW (SHEET 43)

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SIGMA SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 33 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
BLACK CREEK SW QUADRANGLE
SHEET NUMBER 34 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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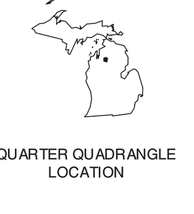
NORTH



QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES 0.5 0 0.5

FEET 500 0 500 1000 1500 2000 2500 3000 3500

KILOMETERS 0.5 0 0.5

1	2	3
4		5
6	7	8

1 SIGMA NE (SHEET 24)
2 BLACK CREEK NW (SHEET 25)
3 BLACK CREEK NE (SHEET 26)
4 SIGMA SE (SHEET 33)
5 BLACK CREEK SE (SHEET 35)
6 SHARON NE (SHEET 42)
7 FLETCHER NW (SHEET 43)
8 FLETCHER NE (SHEET 44)

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BLACK CREEK SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 34 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
BLACK CREEK SE QUADRANGLE
SHEET NUMBER 35 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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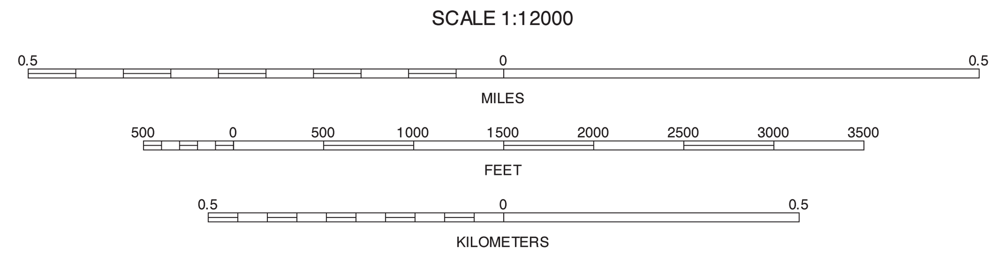

1	2	3
4		5
6	7	8

1 BLACK CREEK NW (SHEET 25)
2 BLACK CREEK NE (SHEET 26)
3 LAKE MARGRETHE NW (SHEET 27)
4 BLACK CREEK SW (SHEET 34)
5 LAKE MARGRETHE SW (SHEET 36)
6 FLETCHER NW (SHEET 43)
7 FLETCHER NE (SHEET 44)
8 COTE DAME MARIE NW (SHEET 45)

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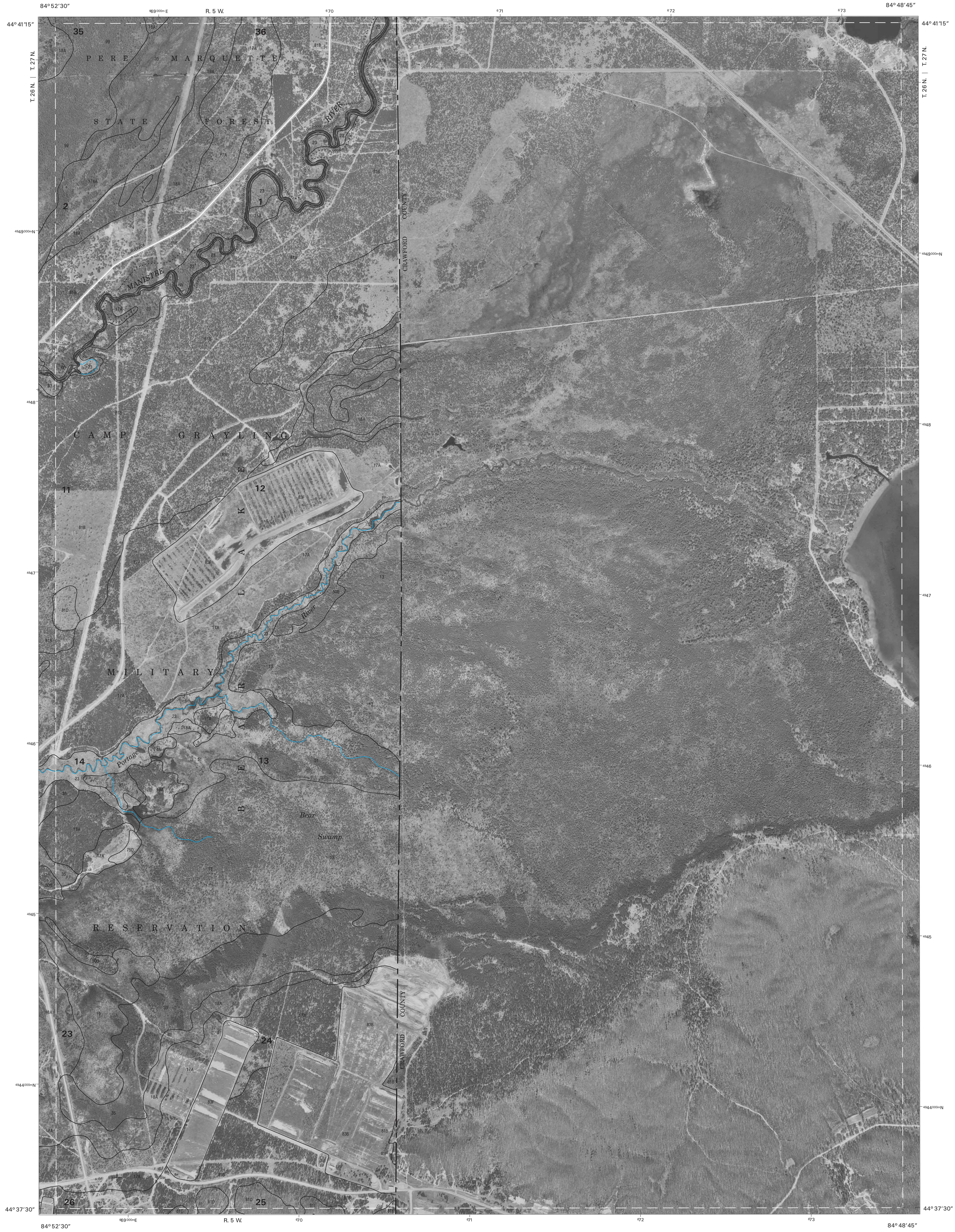
BLACK CREEK SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 35 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
LAKE MARGRETHE SW QUADRANGLE
SHEET NUMBER 36 OF 54



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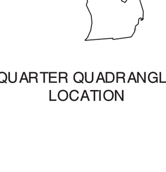
NORTH



QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 BLACK CREEK NE (SHEET 26)
2 LAKE MARGRETHE NW (SHEET 27)
3 LAKE MARGRETHE NE
4 BLACK CREEK SE (SHEET 35)
5 LAKE MARGRETHE SE
6 FLETCHER NE (SHEET 44)
7 COTE DAME MARIE NW (SHEET 45)
8 COTE DAME MARIE NE

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LAKE MARGRETHE SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 36 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
FIFE LAKE NW QUADRANGLE
SHEET NUMBER 37 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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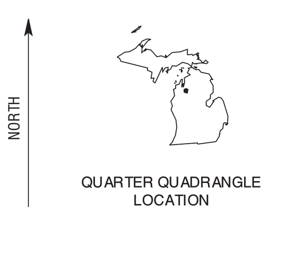

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 JACKS LANDING SE
2 SOUTH BOARDMAN SW (SHEET 28)
3 SOUTH BOARDMAN SE (SHEET 29)
4 WALTON NE
5 FIFE LAKE NE (SHEET 38)
6 WALTON SE
7 FIFE LAKE SW (SHEET 46)
8 FIFE LAKE SE (SHEET 47)

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FIFE LAKE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 37 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
FIFE LAKE NE QUADRANGLE
SHEET NUMBER 38 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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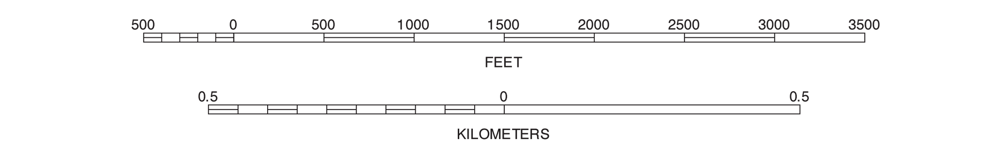
SCALE 1:12000



1	2	3
4		5
6	7	8

1 SOUTH BOARDMAN SW (SHEET 28)
2 SOUTH BOARDMAN SE (SHEET 29)
3 KALKASKA SW (SHEET 30)
4 FIFE LAKE NW (SHEET 37)
5 SMITHVILLE NW (SHEET 39)
6 FIFE LAKE SW (SHEET 46)
7 FIFE LAKE SE (SHEET 47)
8 SMITHVILLE SW (SHEET 48)

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FIFE LAKE NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 38 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SMITHVILLE NW QUADRANGLE
SHEET NUMBER 39 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 SOUTH BOARDMAN SE (SHEET 29)
2 KALKASKA SW (SHEET 30)
3 KALKASKA SE (SHEET 31)
4 FIFE LAKE NE (SHEET 38)
5 SMITHVILLE NE (SHEET 40)
6 FIFE LAKE SE (SHEET 47)
7 SMITHVILLE SW (SHEET 48)
8 SMITHVILLE SE (SHEET 49)

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SMITHVILLE NW, MICHIGAN

3.75 MINUTE SERIES

SHEET NUMBER 39 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SMITHVILLE NE QUADRANGLE
SHEET NUMBER 40 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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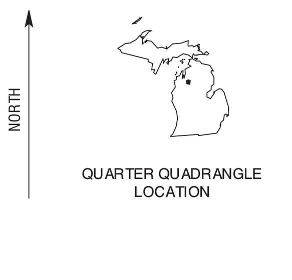

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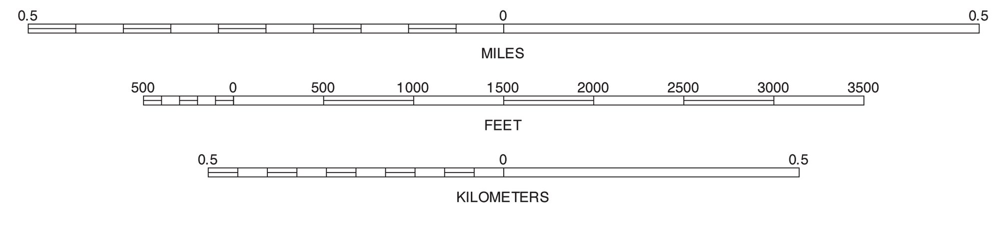

1	2	3
4		5
6	7	8

1 KALKASKA SW (SHEET 30)
2 KALKASKA SE (SHEET 31)
3 SIGMA SW (SHEET 32)
4 SMITHVILLE NW (SHEET 39)
5 SHARON NW (SHEET 41)
6 SMITHVILLE SW (SHEET 48)
7 SMITHVILLE SE (SHEET 49)
8 SHARON SW (SHEET 50)

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UNITED STATES
DEPARTMENT OF AGRICULTURE
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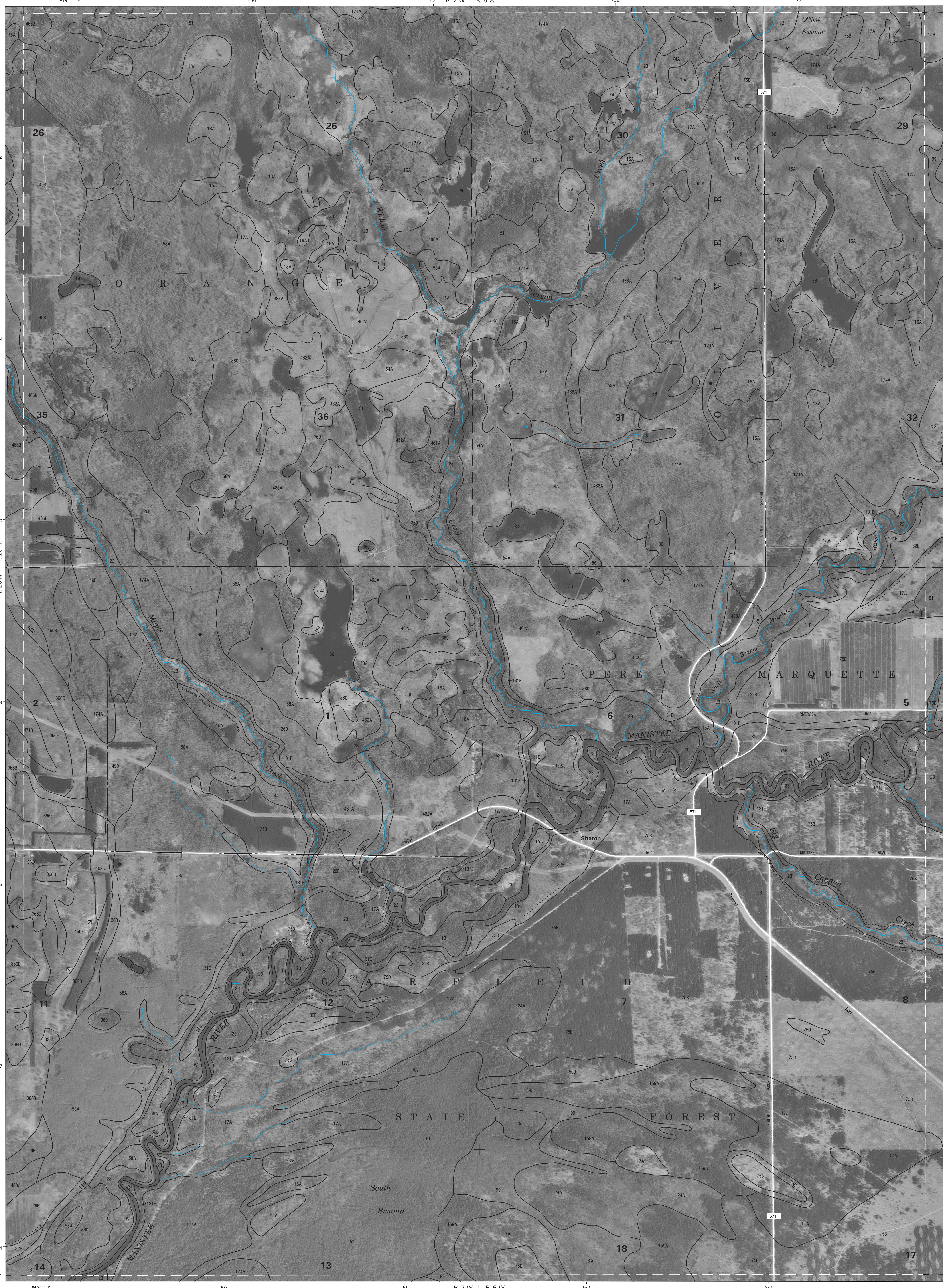
KALKASKA COUNTY, MICHIGAN
SHARON NW QUADRANGLE
SHEET NUMBER 41 OF 54



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 KALKASKA SE (SHEET 31)
2 SIGMA SW (SHEET 32)
3 SIGMA SE (SHEET 33)
4 SMITHVILLE NE (SHEET 40)
5 SHARON NE (SHEET 42)
6 SMITHVILLE SE (SHEET 49)
7 SHARON SW (SHEET 50)
8 SHARON SE (SHEET 51)

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UNITED STATES
DEPARTMENT OF AGRICULTURE
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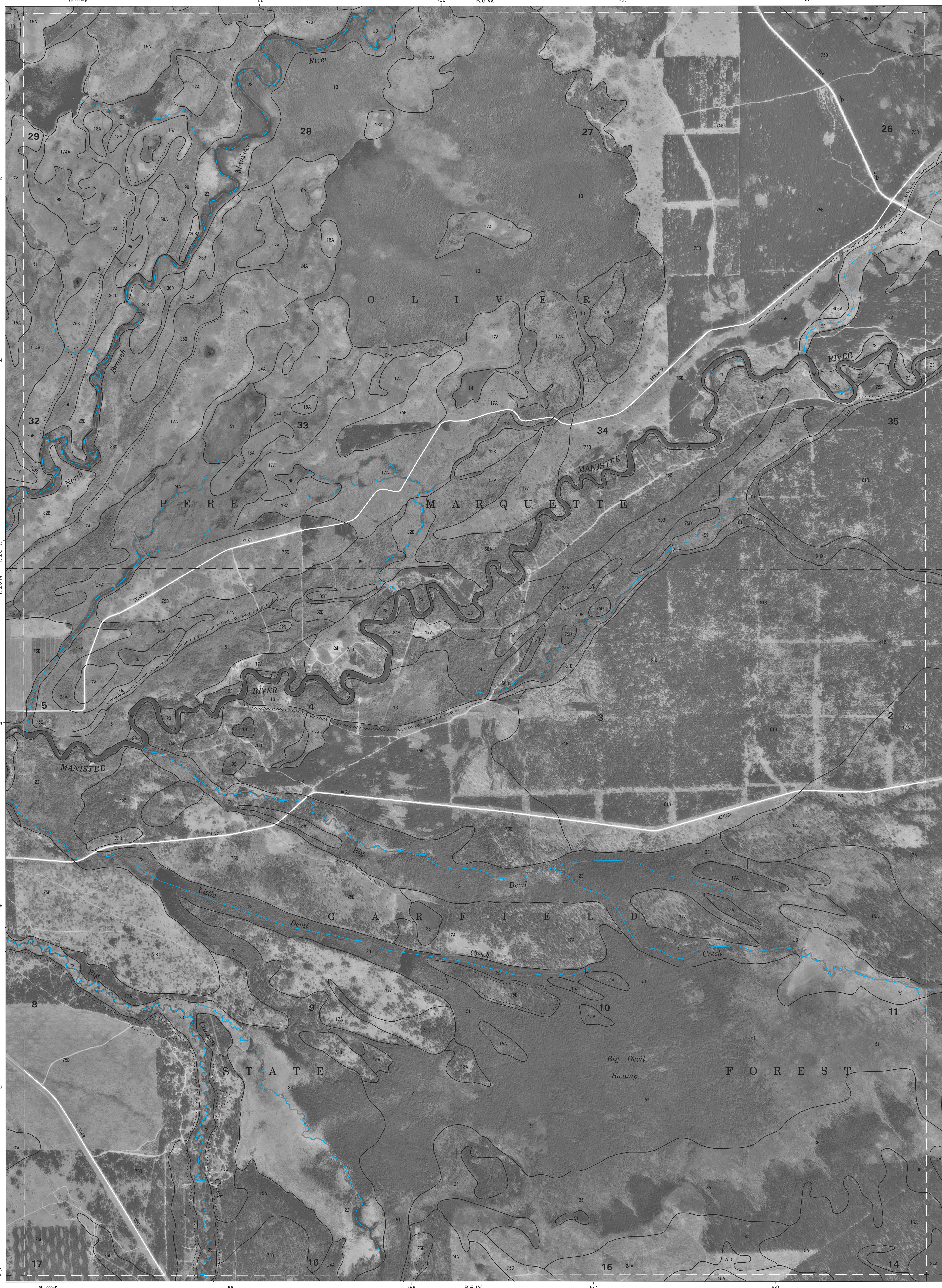
KALKASKA COUNTY, MICHIGAN
SHARON NE QUADRANGLE
SHEET NUMBER 42 OF 54



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5 MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500 FEET

0.5 — 0 — 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 SIGMA SW (SHEET 32)
2 SIGMA SE (SHEET 33)
3 BLACK CREEK SW (SHEET 34)
4 SHARON NW (SHEET 41)
5 FLETCHER NW (SHEET 43)
6 SHARON SW (SHEET 50)
7 SHARON SE (SHEET 51)
8 FLETCHER SW (SHEET 52)

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UNITED STATES
DEPARTMENT OF AGRICULTURE
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KALKASKA COUNTY, MICHIGAN
FLETCHER NW QUADRANGLE
SHEET NUMBER 43 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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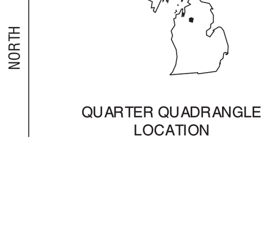
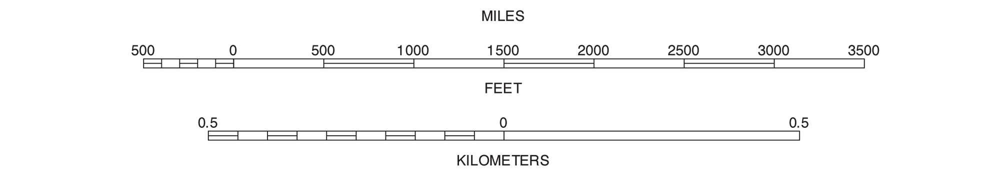


QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 SIGMA SE (SHEET 33)
2 BLACK CREEK SW (SHEET 34)
3 BLACK CREEK SE (SHEET 35)
4 SHARON NE (SHEET 42)
5 FLETCHER NE (SHEET 44)
6 SHARON SE (SHEET 51)
7 FLETCHER SW (SHEET 52)
8 FLETCHER SE (SHEET 53)

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SHEET NUMBER 43 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
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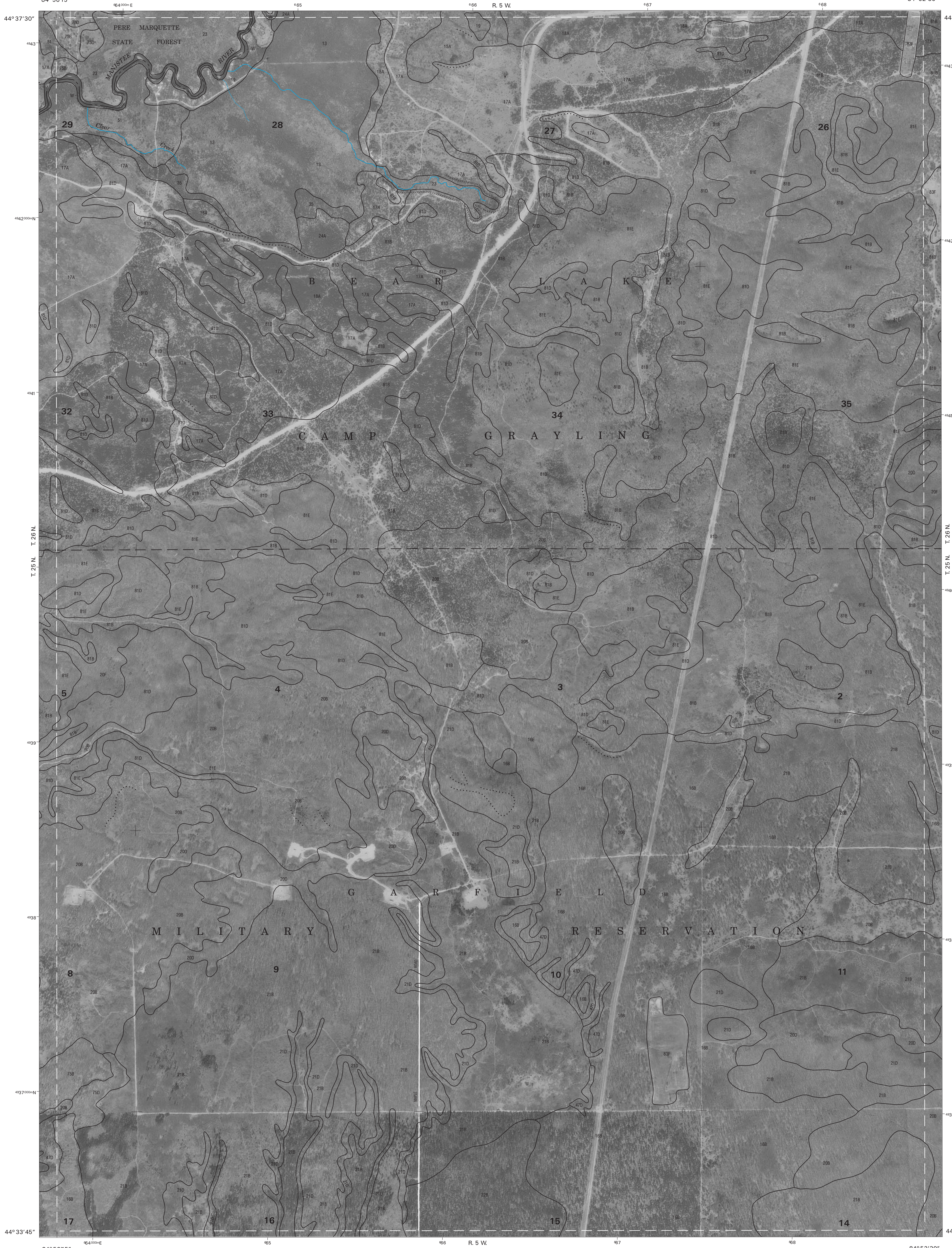

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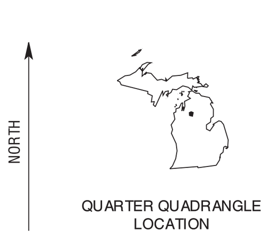
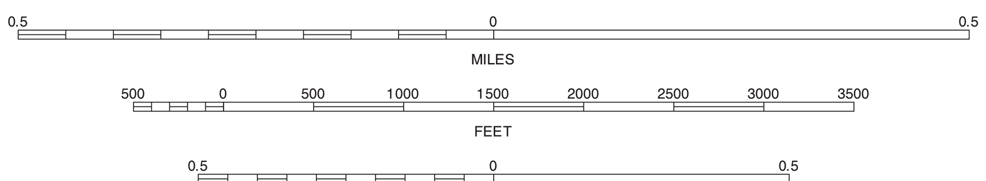


QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 BLACK CREEK SW (SHEET 34)
2 BLACK CREEK SE (SHEET 35)
3 LAKE MARGRETHE SW (SHEET 36)
4 FLETCHER NW (SHEET 43)
5 COTE DAME MARIE NW (SHEET 45)
6 FLETCHER SW (SHEET 52)
7 FLETCHER SE (SHEET 53)
8 COTE DAME MARIE SW (SHEET 54)

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NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
COTE DAME MARIE NW QUADRANGLE
SHEET NUMBER 45 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES · FEET · KILOMETERS

1	2	3
4		5
6	7	8

1 BLACK CREEK SE (SHEET 35)
2 LAKE MARGRETHE SW (SHEET 36)
3 LAKE MARGRETHE SE
4 FLETCHER NE (SHEET 44)
5 COTE DAME MARIE NE
6 FLETCHER SE (SHEET 53)
7 COTE DAME MARIE SW (SHEET 54)
8 COTE DAME MARIE SE

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UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
FIFE LAKE SW QUADRANGLE
SHEET NUMBER 46 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 WALTON NE
2 FIFE LAKE NW (SHEET 37)
3 FIFE LAKE NE (SHEET 38)
4 WALTON SE
5 FIFE LAKE SE (SHEET 47)
6 MANTON NE
7 ARLENE NW
8 ARLENE NE

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DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
FIFE LAKE SE QUADRANGLE
SHEET NUMBER 47 OF 54

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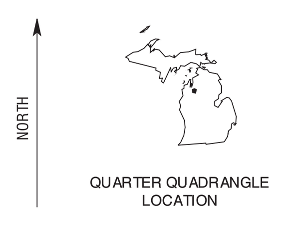

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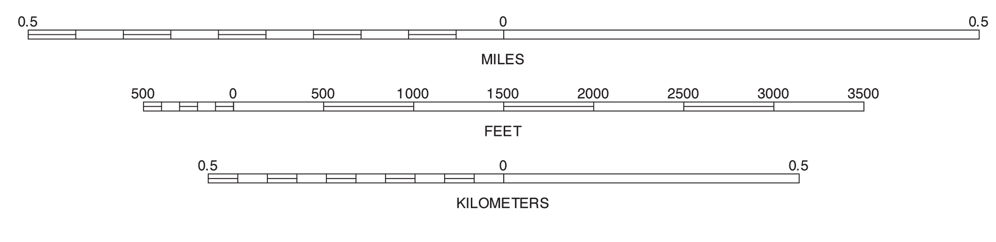

1	2	3
4		5
6	7	8

1 FIFE LAKE NW (SHEET 37)
2 FIFE LAKE NE (SHEET 38)
3 SMITHVILLE NW (SHEET 39)
4 FIFE LAKE SW (SHEET 46)
5 SMITHVILLE SW (SHEET 48)
6 ARLENE NW
7 ARLENE NE
8 MOREY NW

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FIFE LAKE SE, MICHIGAN
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DEPARTMENT OF AGRICULTURE
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KALKASKA COUNTY, MICHIGAN
SMITHVILLE SW QUADRANGLE
SHEET NUMBER 48 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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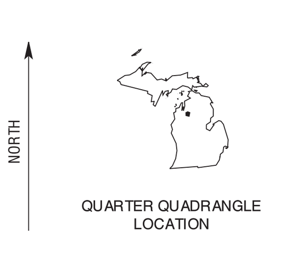

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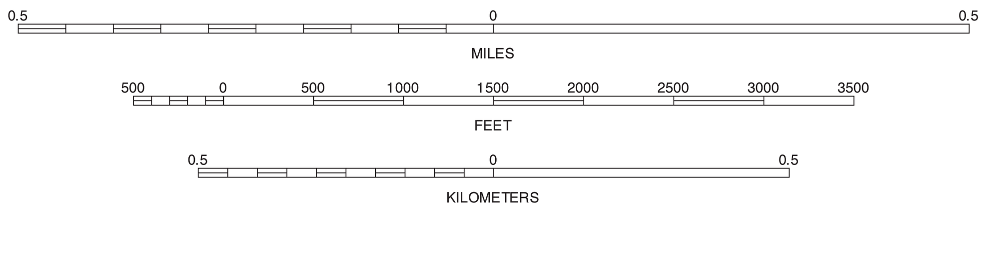

1	2	3
4		5
6	7	8

1 FIFE LAKE NE (SHEET 38)
2 SMITHVILLE NW (SHEET 39)
3 SMITHVILLE NE (SHEET 40)
4 FIFE LAKE SE (SHEET 47)
5 SMITHVILLE SE (SHEET 49)
6 ARLENE NE
7 MOREY NW
8 MOREY NE

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UNITED STATES
DEPARTMENT OF AGRICULTURE
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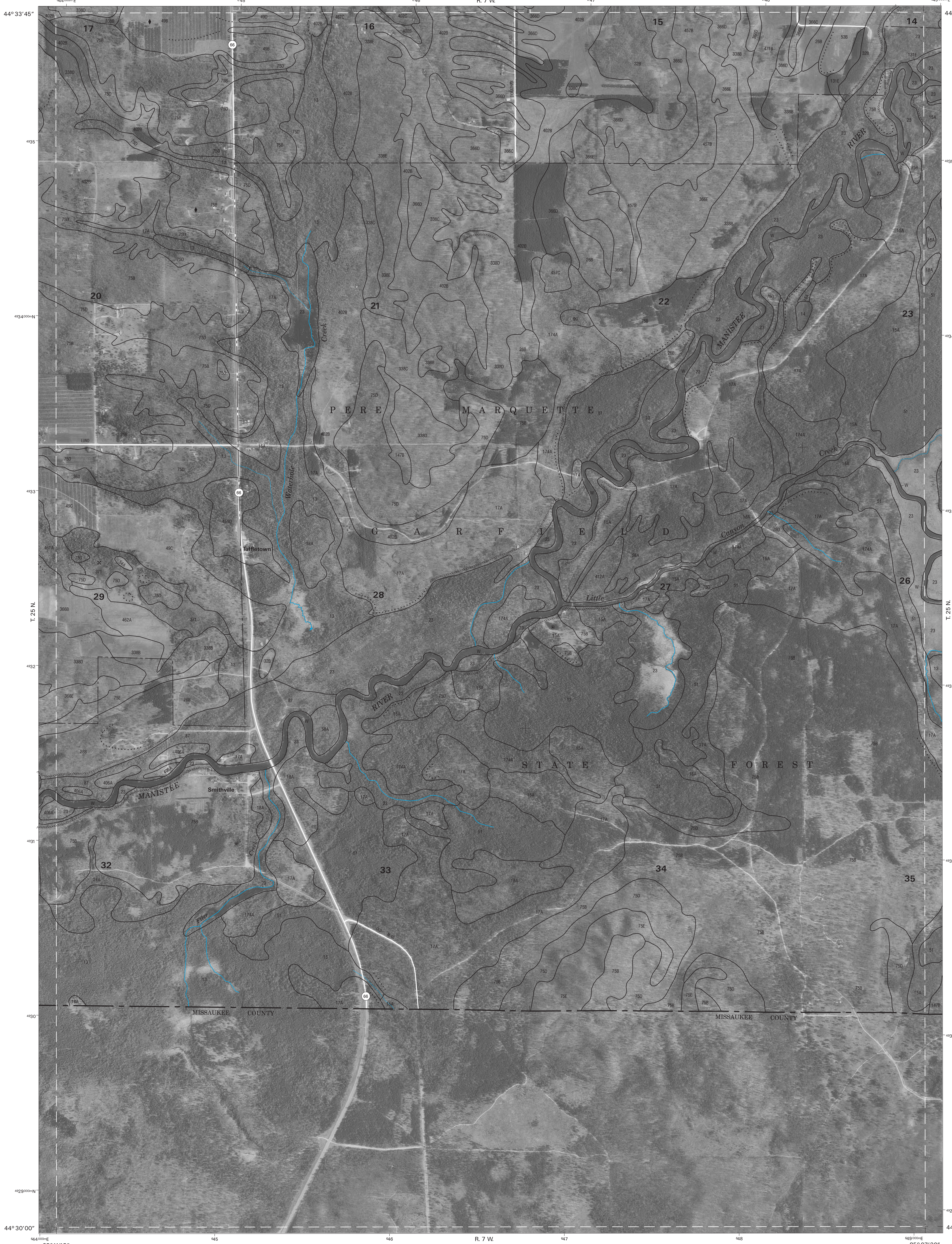
KALKASKA COUNTY, MICHIGAN
SMITHVILLE SE QUADRANGLE
SHEET NUMBER 49 OF 54



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 0 0.5

FEET: 500 0 500 1000 1500 2000 2500 3000 3500

KILOMETERS: 0.5 0 0.5

1	2	3
4		5
6	7	8

1 SMITHVILLE NW (SHEET 39)
2 SMITHVILLE NE (SHEET 40)
3 SHARON NW (SHEET 41)
4 SMITHVILLE SW (SHEET 48)
5 SHARON SW (SHEET 50)
6 MOREY NW
7 MOREY NE
8 STITTSVILLE NW

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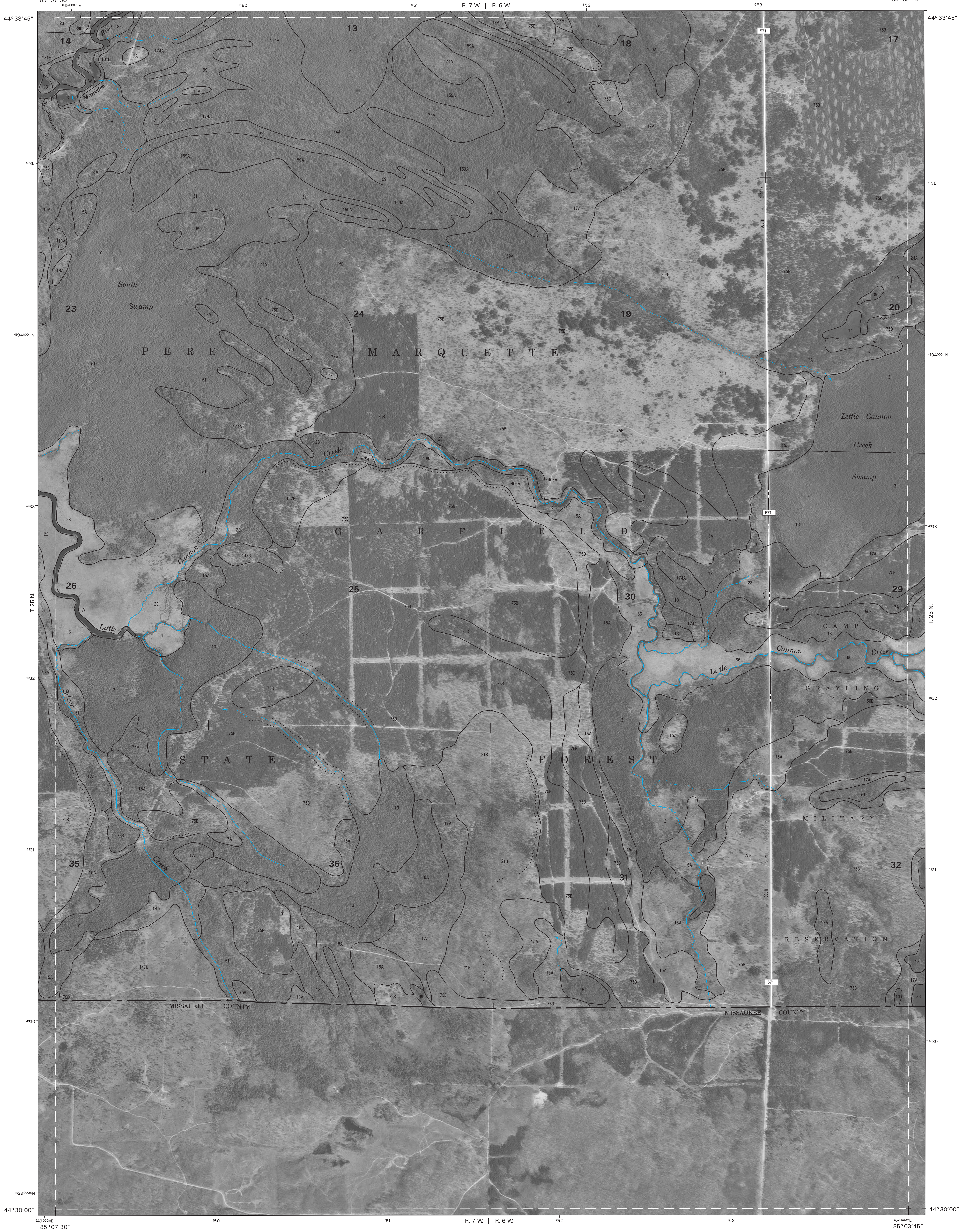
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SHARON SW QUADRANGLE
SHEET NUMBER 50 OF 54



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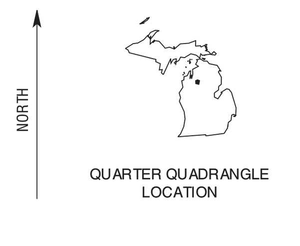
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 SMITHVILLE NE (SHEET 40)
2 SHARON NW (SHEET 41)
3 SHARON NE (SHEET 42)
4 SMITHVILLE SE (SHEET 49)
5 SHARON SE (SHEET 51)
6 MOREY NE
7 STITTSVILLE NW
8 STITTSVILLE NE

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UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MICHIGAN
SHARON SE QUADRANGLE
SHEET NUMBER 51 OF 54

SCALE 1:12000

0.5 — 0 — 0.5 MILES

500 0 500 1000 1500 2000 2500 3000 3500 FEET

0.5 — 0 — 0.5 KILOMETERS

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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NORTH

QUARTER QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 SHARON NW (SHEET 41)
2 SHARON NE (SHEET 42)
3 FLETCHER NW (SHEET 43)
4 SHARON SW (SHEET 50)
5 FLETCHER SW (SHEET 52)
6 STITTSVILLE NW
7 STITTSVILLE NE
8 ADDIS CREEK NW

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UNITED STATES
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KALKASKA COUNTY, MICHIGAN
FLETCHER SW QUADRANGLE
SHEET NUMBER 52 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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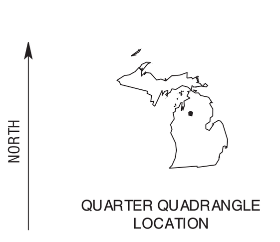

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1 SHARON NE (SHEET 42)
2 FLETCHER NW (SHEET 43)
3 FLETCHER NE (SHEET 44)
4 SHARON SE (SHEET 51)
5 FLETCHER SE (SHEET 53)
6 STITTSVILLE NE
7 ADDIS CREEK NW
8 ADDIS CREEK NE

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KALKASKA COUNTY, MICHIGAN
FLETCHER SE QUADRANGLE
SHEET NUMBER 53 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

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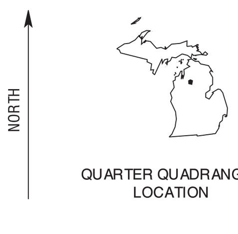
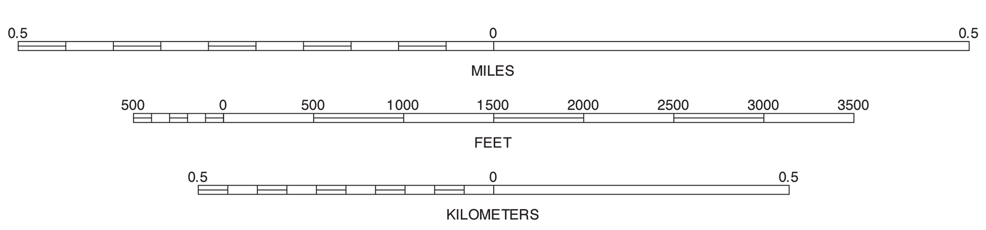


QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 FLETCHER NW (SHEET 43)
2 FLETCHER NE (SHEET 44)
3 COTE DAME MARIE NW (SHEET 45)
4 FLETCHER SW (SHEET 52)
5 COTE DAME MARIE SW (SHEET 54)
6 ADDIS CREEK NW
7 ADDIS CREEK NE
8 MEADS LANDING NW

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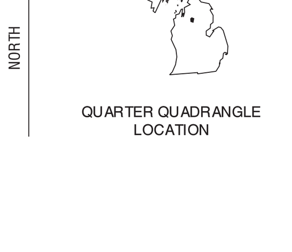
FLETCHER SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 53 OF 54

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

KALKASKA COUNTY, MI
COTE DAME MARIE SW QUADRANGLE
SHEET NUMBER 54 OF 54

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1993-1994 aerial photography. The cultural and hydrography information were acquired from the U.S. Geological Survey. The cultural and hydrography information were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets. Digital data are available for this quadrangle.



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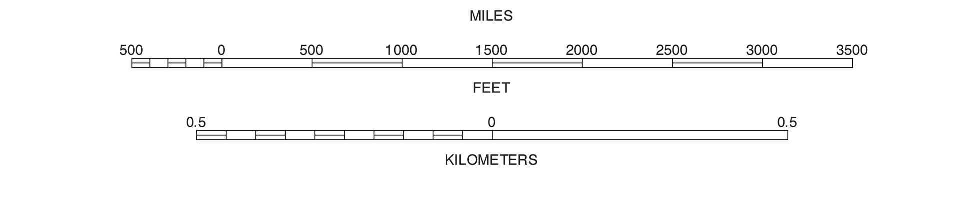

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